SWEIS Yearbook — 1999

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In memory of
Our Friend, Colleague, and
Cofounder of The SWEIS Yearbook

Ann Pendergrass

Cover inset photo: The first Waste Isolation Pilot Plant shipment leaving Los Alamos in March, 1999.

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Comparison of 1999 Data to Projections of the Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory

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PREFACE

In the Record of Decision for Stockpile Stewardship and Management, the US Department of Energy (DOE) charged Los Alamos National Laboratory (LANL or Laboratory) with several new tasks, including war reserve pit production. DOE evaluated the potential environmental impacts of these assignments in the Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory (DOE 1999a). This Site-Wide Environmental Impact Statement (SWEIS) provided the basis for DOE decisions to implement these new assignments at LANL through the Record of Decision (ROD) issued in September 1999.

The Annual Yearbook compares operational data with the projections of the SWEIS for the level of operations selected by the ROD. The SWEIS 1998 Yearbook was issued in December 1999. A special edition of the SWEIS Yearbook, "Wildfire 2000," was issued in August 2000, comparing the wildfire accident analysis of the SWEIS with the Cerro Grande fire that occurred in May 2000. This is the SWEIS Yearbook for 1999. The SWEIS Yearbook for 2000 will include the effects of the Cerro Grande fire on operations and the environmental setting.

The Yearbooks will contain the data needed for trend analyses, will compare projections and actual operations, and will enable decision-makers to determine when and if an updated SWEIS or other National Environmental Policy Act analysis is necessary.

As with the special "Wildfire 2000" edition, the cover of this and future Yearbooks will include an insert photograph depicting an important event that happened during the calendar year under review. The photo selected for this cover highlights LANL's initial shipments of transuranic waste for disposal at the Waste Isolation Pilot Plant.

EXECUTIVE SUMMARY

In 1999, the US Department of Energy (DOE) published a Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory (DOE 1999a). DOE issued a Record of Decision (ROD) for this document in September 1999 (DOE 1999b).

To enhance the usefulness of this Site-Wide Environmental Impact Statement (SWEIS), DOE and Los Alamos National Laboratory (LANL) implemented an assessment tool, the annual yearbook, making comparisons between SWEIS projections and actual operations. Each yearbook focuses on operations during one calendar year and specifically addresses the following:

- facility and/or process modifications or additions,
- types and levels of operations during the calendar year,
- operations data for the Key Facilities, and
- site-wide effects of operations for the calendar year.

This Yearbook addresses capabilities and operations using the concept of the "Key Facility" as presented in the SWEIS. The definition of each Key Facility hinges upon operations (research, production, or services) and capabilities and is not necessarily confined to a single structure, building, or technical area (TA). Chapter 2 discusses each of the 15 Key Facilities from three aspects—significant facility construction and modifications that have occurred during 1999, the types and levels of operations that occurred during 1999, and the 1999 operations data. Chapter 2 also discusses the "Non-Key Facilities," which include all buildings and structures not part of a Key Facility, or the balance of LANL.

During 1999, planned construction and/or modifications continued at eight of the fifteen Key Facilities. Most of these activities were modifications within existing structures. At the High Explosives Testing Facility, construction continued on the Dual-Axis Radiographic Hydrodynamic Test facility. Installation and component testing of the accelerator and its associated control and diagnostics systems began in 1999. Additionally, five major construction projects were started or continued for the "Non-Key Facilities." Four projects were in the construction phase: Atlas, the Industrial Research Park, the Strategic Computing Complex, and the Nonproliferation and International Security Center. The other project, the Central Health Physics Calibration Laboratory, was in the design phase.

The ROD projected a total of 38 facility construction and modification projects for LANL. Thirteen projects have now been completed: seven in 1999 and six in 1998. Ten additional projects were started and/or continued in 1999. The seven projects completed in 1999 are

- replacement of the graphite collection systems at Sigma,
- modification of the industrial drain system at Sigma,
- replacement of electrical components at Sigma,
- relocation of the Weapons Components Testing Facility at High Explosives Processing,
- making the Low-Energy Demonstration Accelerator operational,
- bringing the new ultra-filtration and reverse osmosis process on-line at the Radioctive Liquid Waste Treatment Facility (RLWTF), and
- bringing the nitrate reduction equipment on-line at RLWTF.

A major modification project, elimination and/or rerouting of National Pollutant Discharge Elimination System (NPDES) outfalls, continued. During 1999, 16 additional outfalls were eliminated leaving LANL with only 20 outfalls on its NPDES permit.

This edition of the Yearbook is reporting chemical usage and calculated emissions (expressed as kilograms per year) for the Key Facilities, based on an improved chemical reporting system. The 1999 chemical usage amounts were extracted from the Laboratory's Automated Chemical Inventory System. The quantities used for this report represent all chemicals procured or brought on site in 1999. The chemical comparison indicates that the number of chemicals used in 1999 at each of the Key Facilities and across the Laboratory was substantially less than that number evaluated by the ROD. These changes are believed to be a result of more accurate chemical data collection. Information is presented in the Appendix related to actual chemical use and estimated emissions for each Key Facility. Additional information related to chemical use and emissions reporting can be found in "Emissions Inventory Report Summary, Reporting Requirements for the New Mexico Administrative Code, Title 20, Chapter 2, Part 73 (20 NMAC 2.73) for Calendar Year 1999" (LANL 2000a).

Capabilities across LANL did not change during 1999 although some were defined more broadly while certain operations within a given capability were further refined. During 1999, 90 of the 95 identified capabilities were active. No activity occurred under five capabilities: Fabrication and Metallography at the Chemical and Metallurgy Research Building, Accelerator Transmutation of Wastes at the Los Alamos Neutron Science Center (LANSCE), Medical Isotope Production at LANSCE, Other Waste Processing at the Solid Radioactive and Chemical Waste Facility, and Size Reduction at the Solid Radioactive and Chemical Waste Facility.

As in 1998, only three of LANL's facilities operated during 1999 at levels approximating those projected by the ROD—the Materials Science Laboratory, the Health Research Laboratory, and the Non-Key Facilities. None of these facilities are major contributors to the parameters that lead to significant potential environmental impacts. The remaining 13 Key Facilities all conducted operations at or below projected activity levels.

Radioactive air emissions totaled about 1900 curies compared to 21,700 projected by the ROD. This results in a hypothetical maximum dose to a member of the public of 0.32 millirem (compared to 5.44 projected). Calculated NPDES discharges totaled 317 million gallons compared to a projected volume of 278 million gallons per year. While the number of outfalls has been reduced, the methodology for calculating the discharges changed, and may now result in an overestimate. In addition, the reduction often results from combining flows so that the total number of outfalls is less, but the overall flow is not reduced and exits from a single discharge point. Quantities of solid radioactive and chemical wastes ranged from 3% (mixed low-level radioactive waste) to 475% (chemical waste) of projections. The extremely large quantities of chemical waste (15.4 million kilograms) are a result of Environmental Restoration Program activities (remediation of a former material disposal area). Most chemical wastes are shipped off-site for disposal at commercial facilities; therefore, these large quantities of chemical waste will not impact LANL environs.

Workforce data were above ROD projections. The 12,412 employees at the end of calendar year 1999 represent 1061 more employees than projected. Electricity use during 1999 totaled 369 gigawatt-hours with a peak demand of 68 megawatts compared to projections of 782 gigawatt-hours with a peak demand of 113 megawatts. Water usage was 453 million gallons (compared to 759 million gallons projected), and natural gas consumption totaled 1.43 million decatherms (compared to 1.84 projected). The collective Total Effective Dose Equivalent for the LANL workforce during 1999 was 131 person-rem, which is considerably lower than the workforce dose of 704 person-rem projected by the ROD.

Measured parameters for ecological resources and groundwater were similar to ROD projections, and measured parameters for cultural resources and land resources were below ROD projections. For land use, the ROD projects the disturbance of 41 acres of new land at TA-54 because of the need for additional disposal cells for low-level radioactive waste. As of 1999, this expansion had not yet started. However, groundbreaking did occur on 30 acres of land that are being developed along West Jemez Road for the Industrial Research Park. This project has its own National Environmental Policy Act documentation, and the land is being leased to Los Alamos County for this privately owned development.

Cultural resources remained protected, and no excavation of sites at TA-54 or any other part of LANL has occurred. (The ROD projected that 15 prehistoric sites would be affected by the expansion of Area G into Zones 4 and 6 at TA-54.)

As projected by the ROD, water levels in wells penetrating into the regional aquifer continue to decline in response to pumping, typically by several feet each year. In areas where pumping has slowed or ceased, water levels show some recovery. No unexplained changes in patterns have occurred in the 1995–1999 period, and water levels in the regional aquifer have continued a gradual decline that started in about 1977. In addition, ecological resources are being sustained as a result of protection afforded by DOE ownership of LANL. These resources include biological resources such as protected sensitive species, ecological processes, and biodiversity.

In conclusion, operations data mostly fell within projections. Exceptions were number of employees, which produces a positive impact on the economy of northern New Mexico, and quantities of chemical wastes, which largely resulted from restoration of a former material disposal area. Overall, the operations data indicate that the Laboratory was operating within the SWEIS environmental envelope.

ACKNOWLEDGMENTS

The concept of an Annual Yearbook was developed soon after the SWEIS Project Office was established and is described in the 1995 Quality Management Plan as “making recommendations regarding the ongoing evaluation of Laboratory operations and the environmental envelope established by the SWEIS process.” Ann Pendergrass (LANL), Connie Soden (DOE/AL), Corey Cruz (DOE/AL), and Doris Garvey (LANL) were the creators of this concept and watched over its development. Their oversight and guidance were critical in moving the concept to reality. Without their involvement, the Yearbook would not have happened.

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The Site-Wide Issues Office was the primary preparer of this report. Chief contributors were Doris Garvey, Ken Rea, Chris Del Signore, Allen Valentine, Tony Grieggs, and Julie Meadows.

Jay Brown provided prompt review of the document for classification issues and helped solve several concerns.

Pauline McCormick provided administrative support to the Site-Wide Issues Office, keeping impeccable records so that information would not be lost.

Hector Hinojosa provided editorial support, and Randy Summers served as the designer using text and photographs for a final product.

Many individuals assisted in the collection of information and review of drafts. Data and information came from many parts of the Laboratory, including facility and operating personnel and those who monitor and track environmental parameters. The Yearbook could not have been completed and verified without their help. Though all individuals cannot be mentioned here, the table below identifies major players from each of the Key Facilities and other operations.

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ACRONYMS

ACIS	Automated Chemical Inventory System
ALARA	as low as reasonably achievable
ATW	accelerator transmutation of wastes
BTF	Beryllium Technology Facility
Ci	curie
CMR	Chemical and Metallurgy Research
DARHT	Dual-Axis Radiographic Hydrodynamic Test (facility)
DMR	discharge monitoring report
DOE	Department of Energy
DVRS	Decontamination and Volume Reduction System
DX	Dynamic Experimentation (Division)
EPA	Environmental Protection Agency
ER	Environmental Restoration (Project)
ESA	Engineering Sciences and Application (Division)
FTE	full-time equivalent (employee)
GWH	gigawatt-hours
HEWTF	High Explosives Wastewater Treatment Facility
HMP	Habitat Management Plan
HRL	Health Research Laboratory
IRP	Industrial Research Park
JCNNM	Johnson Controls of Northern New Mexico
KW	kilowatt
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LAPP	Los Alamos Power Pool
LEDA	Low-Energy Demonstration Accelerator
LIDAR	light detection and ranging
LIFT	Los Alamos International Facility for Transmutation
linac	linear accelerator
LLW	low-level radioactive waste
LPSS	Long-Pulse Spallation Source
LWC	Lost Workday Case Rate
m	meter
MDA	material disposal area
MEI	maximally exposed individual
MeV	million electron volts
MGY	million gallons per year
MLLW	mixed low-level radioactive waste
MSL	Materials Science Laboratory
MW	megawatt
NEPA	National Environmental Policy Act
NISC	Nonproliferation and International Security Center

NMED	New Mexico Environment Department
NMSF	Nuclear Materials Storage Facility
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
PNM	Public Service Company of New Mexico
PRS	potential release site
PTLA	Protection Technology Los Alamos
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
RFI	RCRA facility investigation
RLW	radioactive liquid waste
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	record of decision
SCC	Strategic Computing Complex
SNM	special nuclear material
SWEIS	Site-Wide Environmental Impact Statement
SWS	Sanitary Wastewater System
TA	technical area
TEDE	total effective dose equivalent
TFF	Target Fabrication Facility
TRI	Total Recordable Incident Rate
TRU	transuranic
TSFF	Tritium Science and Fabrication Facility
TSTA	Tritium System Test Assembly (facility)
TWISP	Transuranic Waste Inspectable Storage Project
UC	University of California
UF/RO	ultrafiltration/reverse osmosis
WCRRF	Waste Characterization, Reduction, and Repackaging Facility
WETF	Weapons Engineering and Tritium Facility
WIPP	Waste Isolation Pilot Plant
WNR	Weapons Neutron Research (facility)

1.0 Introduction

1.1 The SWEIS

In 1999, the US Department of Energy (DOE) published a Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory (DOE 1999a). DOE issued its Record of Decision (ROD) on this Site-Wide Environmental Impact Statement (SWEIS) in September 1999 (DOE 1999b). The ROD identified the decisions DOE made on the levels of operation for Los Alamos National Laboratory (LANL) for the foreseeable future.

1.2 Annual Yearbook

To enhance the usefulness of this SWEIS, a National Environmental Policy Act (NEPA) document, DOE and LANL implemented an assessment tool that makes annual comparisons between SWEIS projections and actual operations via an annual Yearbook. The Yearbook's purpose is not to present environmental impacts or environmental consequences, but rather to provide data that could be used to develop an impact analysis. The annual Yearbook focuses on

- Facility and process modifications or additions (Chapter 2). These include projected activities, for which NEPA coverage was provided by the SWEIS, and certain other activities for which environmental coverage was not provided in the SWEIS. In the latter case, the Yearbook identifies the additional NEPA analyses (i.e., categorical exclusions and environmental assessments) that were performed.
- The types and levels of operations during the calendar year (Chapter 2). Types of operations are described using the capabilities defined in the SWEIS. Levels of operations are expressed in units of production, numbers of researchers, numbers of experiments, hours of operation, and other descriptive units.
- Operations data for the Key Facilities, comparable to data projected in the SWEIS (Chapter 2). Data for each facility include waste generated, air emissions, liquid effluents, and number of workers.
- Site-wide effects of operations for the calendar year (Chapter 3). These include measures such as number of workers, radiation doses, workplace incidents, utility requirements, air emissions, liquid effluents, and solid wastes. These effects also include changes in the regional aquifer, ecological resources, and other resources for which the DOE has long-term stewardship responsibilities as an owner of federal lands.

Data for comparison come from a variety of sources, including facility records, operations reports, facility personnel, and the annual Environmental Surveillance Report. The focus on operations rather than on programs, missions, or funding sources is consistent with the approach of the SWEIS.

The annual Yearbooks provide DOE with information needed to evaluate adequacy of the SWEIS and will enable DOE to make a decision on when and if a new SWEIS is needed. The Yearbook will also be a guide to facilities and managers at the Laboratory in determining whether activities are within the SWEIS operating envelope. The report does not reiterate the detailed information found in other LANL documents, but rather points the interested reader to those documents for the additional detail. The Yearbook serves as a guide to environmental information collected and reported by the various groups at LANL.

1.3 This Yearbook

The ROD selected the levels of operations, and the SWEIS provided projections for these operations.This Yearbook compares data for calendar year 1999 to the appropriate SWEIS projections. Hence, this report uses the phrases “SWEIS ROD projections,” “SWEIS ROD,” or “ROD” to convey this concept, as appropriate.

The collection of data on facility operations is a unique effort. The type of information developed for the SWEIS is not routinely collected at LANL. Nevertheless, this information is the heart of the SWEIS and the Yearbook. Although this requires a special effort, the description of current operations and indications of future changes in operations is believed to be sufficiently important to warrant an incremental effort.

This Yearbook also presents the concept of additive analysis (Chapter 4). Though only two years of data exist, the concept is introduced and the groundwork laid for discussion in future years.

2.0 Facilities and Operations

LANL,which is located in northern New Mexico (Figure 2-1), has more than 2000 structures with approximately eight million square feet under roof, spread over an area of 43 square miles. In order to present a logical and comprehensive evaluation of LANL's potential environmental impacts, the SWEIS developed the Key Facility concept. Fifteen facilities were identified that were both critical to meeting mission assignments and

- housed operations that have the potential to cause significant environmental impacts, or
- were of most interest or concern to the public (based on comments in the SWEIS public hearings), or
- would be more subject to change because of DOE programmatic decisions.

The remainder of LANL was called "Non-Key," not to imply that these facilities were any less important to the accomplishment of critical research and development, but because they did not fit the above criteria (DOE 1999a, p. 2-17).

Taken together, the 15 Key Facilities represent the great majority of environmental risks associated with LANL operations. Specifically, the Key Facilities contribute

- more than 99% of all potential radiation doses to the public,
- more than 90% of all radioactive liquid waste (RLW) generated at LANL,
- more than 90% of the radioactive solid waste generated at LANL,
- more than 99% of all radiation doses to the LANL workforce, and
- approximately 30% of all chemical waste generated by LANL.

In addition, the Key Facilities comprise 42 of the 48 Category 2 and Category 3 nuclear facilities at LANL[1]. Several changes have been made to the status of nuclear facility classifications. However, these changes were not incorporated in the December 1998 DOE List of Los Alamos National Laboratory Nuclear Facilities and therefore are not reported here. Once the DOE list is updated, those changes will be reflected in the appropriate LANL SWEIS yearbook.

The definition of each Key Facility hinges upon operations[2], capabilities, and location and is not necessarily confined to a single structure, building, or technical area (TA). In fact, the number of structures comprising a Key Facility ranges from one, the Material Sciences Laboratory (MSL), to more than 400 for the Los Alamos Neutron Science Center (LANSCE). Key Facilities can also exist in more than a single TA, as is the case with the High Explosives Processing and High Explosives Testing Key Facilities, which exist in all or parts of five and seven TAs, respectively.

[1] DOE Order 5480.23 (DOE 1992a) categorizes nuclear hazards as Category 1, Category 2, or Category 3. Because LANL has no Category 1 nuclear facilities (usually applied to nuclear reactors), definitions are presented for only Categories 2 and 3:
Category 2 Nuclear Hazard – has the potential for significant onsite consequences. DOE-STD-1027-92 (DOE 1992b) provides the resulting threshold quantities for radioactive materials that define Category 2 facilities.
Category 3 Nuclear Hazard – has the potential for only significant localized consequences. Category 3 is designed to capture those facilities such as laboratory operations, low-level radioactive waste handling operations, and research operations that possess less than Category 2 quantities of material. DOE-STD-1027-92 (DOE 1992b) provides the Category 3 thresholds for radionuclides.
The identification of nuclear facilities is based upon the official list maintained by DOE Los Alamos Area Office as of December 1998 (DOE 1998a).

[2] As used in the SWEIS and this Yearbook, facility operations include three categories of activities—research, production, and services to other LANL organizations. Research is both theoretical and practical. Examples include modeling (e.g., atmospheric weather patterns) to subatomic investigations (e.g., using the LANSCE linear accelerator [linac]) to collaborative efforts with industry (e.g., fuel cells for automobiles). Production involves the delivery of a product to a customer, such as radioisotopes to hospitals and the medical industry. Examples of services provided to other LANL facilities include utilities and infrastructure support, analysis of samples, environmental surveys, and waste management.

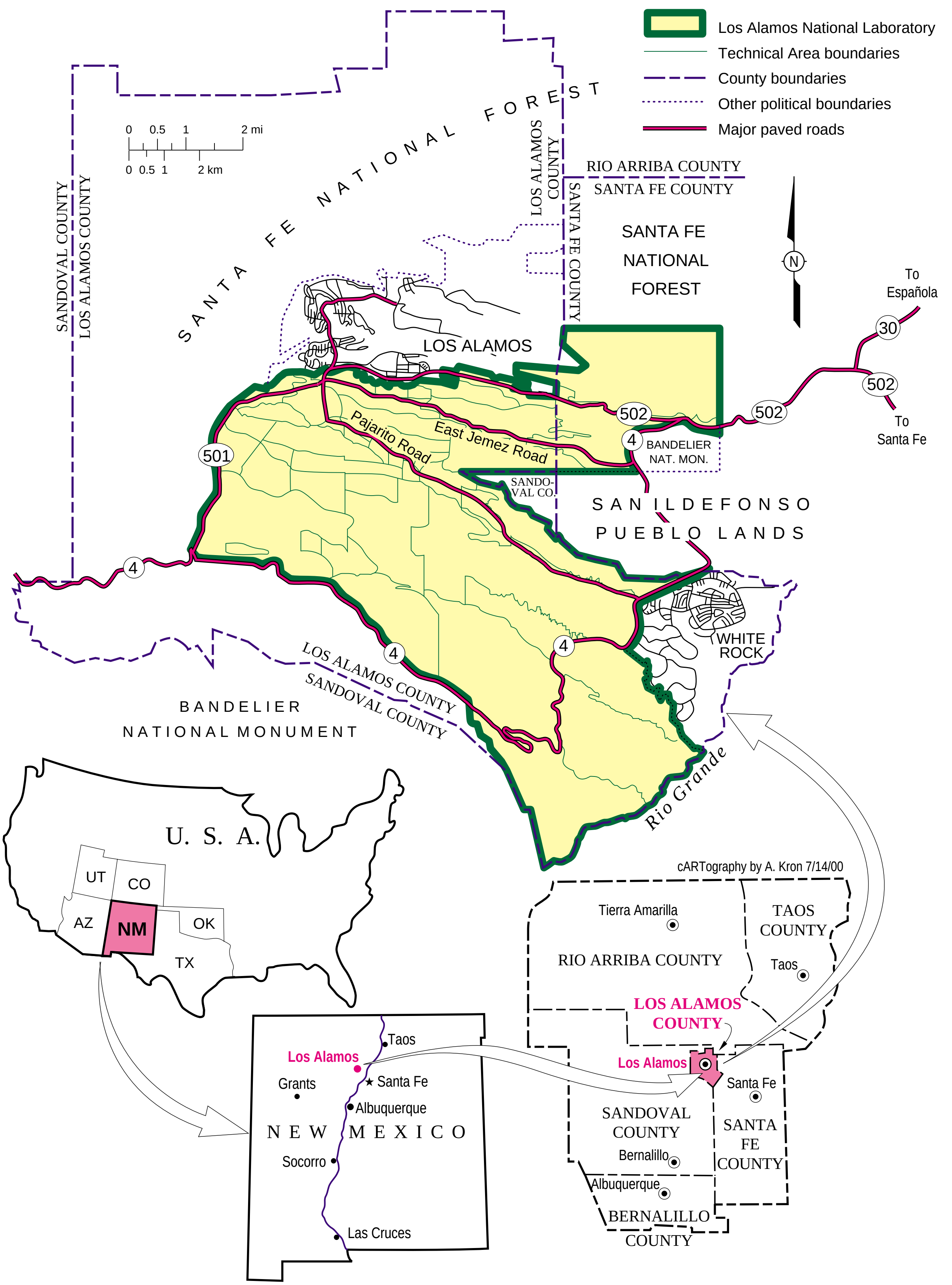

Figure 2-1 Location of Los Alamos National Laboratory

This chapter discusses each of the 15 Key Facilities from three aspects—significant facility construction and modifications that have occurred during 1999, types and levels of operations that occurred during 1999, and the 1999 operations data. Each of these three aspects is given perspective by comparing them to projections made by the ROD. This comparison provides an evaluation of whether or not data resulting from LANL operations continue to fall within the environmental envelope established by the ROD. It should be noted that construction activities projected by the ROD were for the ten-year period 1996–2005. All construction activities will not be complete and projected operations may not reach maximum levels until the end of the ten-year period.

This chapter also discusses the Non-Key Facilities, which include all buildings and structures not part of a Key Facility, or the balance of LANL. Although operations at the Non-Key Facilities do not contribute significantly to radiation doses or generation of radioactive wastes, the Non-Key Facilities represent a significant fraction of LANL. The Non-Key Facilities comprise all or the majority of 30 of LANL's 49 TAs (Figure 2-2), and approximately 15,500 of LANL's 27,820 acres. The Non-Key Facilities also employ about half the LANL workforce. This category includes such important buildings and operations as the Central Computing Facility, the Atlas Facility, the TA-46 sewage treatment facility, and the Main Administration Building. Table 2.0-1 identifies and compares the acreage of the 15 Key Facilities and the Non-Key Facilities, and Figure 2-3 shows the locations of the key facilities.

Table 2.0-1. Key and Non-Key Facilities

FACILITY	TECHNICAL AREAS	~SIZE (ACRES)
Plutonium Complex	TA-55	93
Tritium Facilities	TA-16 & TA-21	312
Chemical and Metallurgy Research Building (CMR)	TA-03	14
Pajarito Site	TA-18	131
Sigma Complex	TA-03	11
MSL	TA-03	2
Target Fabrication Facility (TFF)	TA-35	3
Machine Shops	TA-03	8
High Explosives Processing	TAs 08, 09, 11, 16, 22, 28, 37	1115
High Explosives Testing	TAs 15, 36, 39, 40	8691
LANSCE	TA-53	751
Health Research Laboratory (HRL)	TA-43	4
Radiochemistry Facility	TA-48	116
Radioactive Liquid Waste Treatment Facility (RLWTF)	TA-50	62
Solid Radioactive and Chemical Waste Facilities	TA-50 & TA-54	943
Subtotal, Key Facilities		12,256
Non-Key Facilities	30 of 49 TAs	15,560
LANL		27,816

2.1 Plutonium Complex (TA-55)

The Plutonium Complex Key Facility, a 93-acre site, consists of six primary buildings and a number of lesser buildings and structures. As presented in the SWEIS, this Key Facility contains one operational Category 2 nuclear facility (TA-55-4) and one potential Category 2 nuclear facility (TA-55-41), the Nuclear Material Storage Facility (NMSF), which was undergoing modification to bring it into operational status. In addition, the facility contains two Low Hazard chemical facilities (TA-55-3 and TA-55-5) and one Low Hazard energy source s facility (TA-55-7).

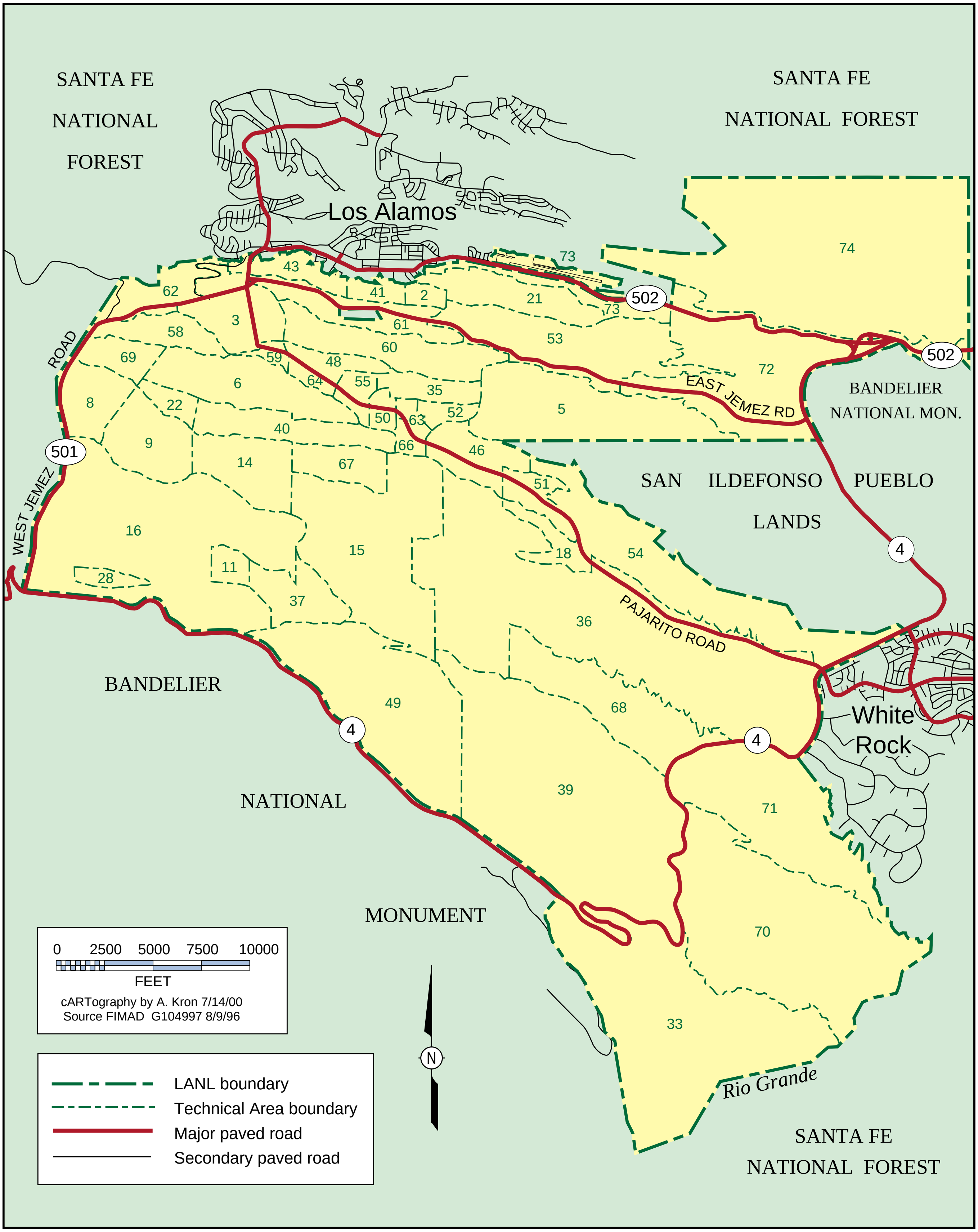

Figure 2-2 Location of Technical Areas

Figure 2-3 Location of Key Facilities

2.1.1 Construction and Modifications at the Plutonium Complex

The ROD projected four facility modifications:

- renovation of the NMSF (currently not in use);
- construction of a new administrative office building (constructed in 1999);
- upgrades within Building 55-4 to support continued manufacturing at the existing capacity of 14 pits per year; and
- further upgrades for long-term viability of the facility and to boost production to a nominal capacity of 20 pits per year.

During calendar year 1999, upgrades to maintain existing capacity were continued and a new office building was constructed at the TA-55 site (the Facilities Improvement Technical Support building). A categorical exclusion was issued for this project (LANL 1998a). Design efforts for renovation of the NMSF were halted. There are no current plans to continue the renovations of NMSF. None of the ongoing construction or modifications at the Plutonium Key Facility resulted in modification to the facility hazard categories by the close of calendar year 1999.

2.1.2 Operations at the Plutonium Complex

The ROD identified seven capabilities[3] for this Key Facility. No new capabilities have been added, and none have been deleted. Research was conducted in all areas projected by the ROD, including the preparation of 10 kilograms of mixed oxide fuel. For all seven capabilities, activity levels were below those projected by the ROD. Table 2.1.2-1 presents details.

Plutonium Complex at TA-55

[3]As defined in the SWEIS, a capability refers to the combination of buildings, equipment, infrastructure, and expertise necessary to undertake types or groups of activities and to implement mission assignments. Capabilities at LANL have been established over time, principally through mission assignments and activities directed by DOE Program Offices.

Table 2.1.2-1. Plutonium Complex/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Plutonium Stabilization	Recover, process, and store the existing plutonium inventory in eight years.	Highest priority items have been stabilized. The implementation plan is being modified between DOE and the Defense Nuclear Facilities Safety Board with a longer completion schedule.
Manufacturing Plutonium Components	Produce nominally 20 war reserve pits/yr. (Requires minor facility modifications.)	There were no war reserve pits produced or accepted by DOE for transfer to the nuclear stockpile. Four development pits were fabricated in preparation for eventual war reserve fabrication.
Surveillance and Disassembly of Weapons Components	Pit disassembly: Up to 65 pits/yr disassembled. Pit surveillance: Up to 40 pits/yr destructively examined and 20 pits/yr nondestructively examined.	Less than 65 pits were disassembled during 1999. Less than 40 pits were destructively examined as part of the stockpile evaluation program (pit surveillance) in 1999.
Actinide Materials and Science Processing, Research, and Development	Develop production disassembly capacity. Process up to 200 pits/yr, including a total of 250 pits (over 4 years) as part of disposition demonstration activities.	Fewer than 200 pits were disassembled/converted in 1999.
	Process neutron sources up to 5000 curies/yr. Process neutron sources other than sealed sources.	Neutron sources are not currently being disassembled and chemically processed.
	Process up to 400 kilograms/yr of actinides.[b] Provide support for dynamic experiments. Process 1 to 2 pits/month (up to 12 pits/yr) through tritium separation.	Less than 400 kilograms/yr of actinides were processed. Support was provided for dynamic experiments. Less than 12 pits/yr were processed through tritium separations in 1999.
	Perform decontamination of 28 to 48 uranium components per month.	In 1999, less than 48 uranium components were decontaminated.
	Research in support of DOE actinide cleanup activities. Stabilize minor quantities of specialty items. Research and development on actinide processing and waste activities at DOE sites, including processing up to 140 kilograms of plutonium as chloride salts from the Rocky Flats Environmental Technology Site.	Research supporting DOE actinide cleanup activities continued at low levels. No plutonium residues from Rocky Flats were processed.
	Conduct plutonium research and development and support. Prepare, measure, and characterize samples for fundamental research and development in areas such as aging, welding and bonding, coatings, and fire resistance.	Sample preparation and characterization continued.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Actinide Materials and Science Processing, Research, and Development (Cont.)	Fabricate and study nuclear fuels used in terrestrial and space reactors. Fabricate and study prototype fuel for lead test assemblies.	Minimal terrestrial and space reactor fuel development occurred in 1999.
	Develop safeguards instrumentation for plutonium assay.	Continued support of safeguards instrumentation development.
	Analyze samples in support of actinide reprocessing and research and development activities.	Analysis of actinide samples at TA-55 continued in support of actinide reprocessing and research and development activities.
Fabrication of Ceramic-Based Reactor Fuels	Build mixed oxide test reactor fuel assemblies and continue research and development on fuels.	Manufactured approximately 10 kg of mixed oxide fuel in 1999.
Plutonium-238 Research, Development, and Applications	Process, evaluate, and test up to 25 kg/yr plutonium-238. Recycle residues and blend up to 18 kg/yr plutonium-238.	Recovered approximately 0.5 kg of plutonium-238 and processed approximately 1.0 kg of plutonium-238 for heat source fuel in 1999.
Special Nuclear Materials (SNM) Storage, Shipping and Receiving	Store up to 6600 kilograms SNM in NMSF; continue to store working inventory in the vault in Building 55-4; ship and receive as needed to support LANL activities.	NMSF is not operational as a storage vault and there are no current plans to complete the modifications required to use the facility as a storage vault. Building 55-4 vault levels remained approximately constant at 1996 levels.
	Conduct nondestructive assay on SNM at NMSF to identify and verify the content of stored containers.	NMSF not operational as a storage vault and was not used for nondestructive assay.

[a] Includes renovation of NMSF, construction of new technical support office building, and upgrades to enable the production of nominally 20 war reserve pits per year.
[b] The actinide activities at the CMR Building and at TA-55 are expected to total 400 kilograms/yr. The future split between these two facilities is not known, so the facility-specific impacts at each facility are conservatively analyzed at this maximum amount. Waste projections that are not specific to the facility (but are related directly to the activities themselves) are only projected for the total of 400 kilograms/yr.

2.1.3 Operations Data for the Plutonium Complex

Details of operational data are presented in Table 2.1.3-1. Radioactive air emissions were less than one percent of projections (less than 2 curies in 1999 compared to 1000 curies projected), and quantities of wastes were also less than projected.

Table 2.1.3-1. Plutonium Complex/Operations Data

PARAMETER	UNITS[a]	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Plutonium-239 [b]	Ci/yr	2.70E-5	1.2E-7
Americium-241	Ci/yr	Not projected [c]	5.4E-8
Tritium in Water Vapor	Ci/yr	7.50E+2	3.1E-1
Tritium as a Gas	Ci/yr	2.50E+2	1.45E+0
Uranium-234	Ci/yr	Not projected [c]	2.0E-8
Uranium-238	Ci/yr	Not projected [c]	5.1E-8
NPDES Discharge [d] 03A181 [e]	MGY	14	8.54

PARAMETER	UNITS[a]	SWEIS ROD	1999 OPERATIONS
Wastes:			
Chemical	kg/yr	8400	2539
LLW [f]	m^3/yr	754 [g]	340
MLLW	m^3/yr	13 [g]	4
TRU/Mixed TRU	m^3/yr	339 [h]	160
TRU	m^3/yr	237 [h]	94
Mixed TRU	m^3/yr	102 [h]	66
Number of Workers	FTEs	1111	589 [i]

[a] Ci/yr = curies per year; MGY = million gallons per year; FTEs = full-time equivalent workers.
[b] Projections for the SWEIS ROD were reported as plutonium or plutonium-239, the primary material at TA-55.
[c] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[d] NPDES is National Pollutant Discharge Elimination System.
[e] This outfall discharged all four quarters during calendar year 1999.
[f] LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; TRU = transuranic.
[g] Includes estimates of waste generated by the facility upgrades associated with pit fabrication.
[h] The ROD provided the data for TRU and Mixed TRU wastes in Chapter 3 and Chapter 5 of the SWEIS. However, the projections made had to be modified to reflect the decision to produce nominally 20 pits per year.
[i] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include Protection Technology Los Alamos (PTLA), Johnson Controls Northern New Mexico (JCNNM), and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only University of California (UC) employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 3.6, Socioeconomics) is not appropriate.

2.2 Tritium Facilities (TA-16 and TA-21)

This Key Facility consists of tritium operations at TA-16 and TA-21. The tritium operations are conducted in three buildings: The Weapons Engineering Tritium Facility (WETF, Building TA-16-205), the Tritium Systems Test Assembly (TSTA, Building TA-21-155N), and the Tritium Science and Fabrication Facility (TSFF, Building TA-21-209). Operations involving the removal of tritium from actinide material are conducted at LANL's TA-55 Plutonium Facility; however, these operations are small in scale and were not included as part of the Tritium Facilities in the SWEIS.

The three facilities, (WETF, TSTA, and TSFF) have tritium inventories greater than 30 grams and thus are Category 2 nuclear facilities.

2.2.1 Construction and Modifications at the Tritium Facilities

No major upgrades were added to WETF at TA-16. Several of the existing systems were upgraded to provide additional capabilities. The remodeling of Building TA-16-450 was continued during 1999.

There have been no facility modifications made to the TA-21 facilities. In November 1999, DOE determined that the TSTA facility has completed its mission and the tritium will be removed from TSTA in the next several years. Only a limited experimental program will be carried out in the facility, and this program should be complete by June 2000.

2.2.2 Operations at the Tritium Facilities

The ROD identified nine capabilities for this Key Facility. No new capabilities have been added, and none have been deleted. Table 2.2.2-1 lists the nine capabilities identified in the SWEIS and presents calendar year 1999 operational data for each of these capabilities. Operations in 1999 were below projections by the ROD and remained within the established environmental envelope. For example, approximately 19 high-pressure gas fill operations were conducted in 1999 (compared to 65 fills projected by the ROD), and approximately 14 gas boost system tests and gas processing operations were performed (compared to 35 projected by the ROD).

Table 2.2.2-1. Tritium Facilities/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
High-Pressure Gas Fills and Processing: WETF	Handling and processing of tritium gas in quantities of up to 100 grams at WETF with no limit on number of operations per year. Capability used approximately 65 times/yr.	Approximately 19 high-pressure gas fills and processing operations.
Gas Boost System Testing and Development: WETF	System testing and gas processing operations involving quantities of up to 100 grams. Capability used approximately 35 times/yr.	Approximately 14 gas boost tests and operations.
Cryogenic Separation: TSTA	Tritium gas purification and processing in quantities up to 200 grams. Capability used five to six times/yr.	One cryogenic separation operation.
Diffusion and Membrane Purification: TSTA, TSFF, WETF	Research on tritium movement and penetration through materials. Expect six to eight experiments/month. Capability also used continuously for effluent treatment.	Approximately zero. Capability not used for continuous effluent treatment.
Metallurgical and Material Research: TSTA, TSFF, WETF	Capability involves materials research including metal getter research and application studies. Small quantities of tritium supports tritium effects and properties research and development. Contributes <2% of LANL's tritium emissions to the environment.	Activities resulted in <1% tritium emissions from each facility.
Thin Film Loading: TSFF (WETF by 2001)	Chemical bonding of tritium to metal surfaces. Current application is for tritium loading of neutron tube targets; perform loading operations up to 3000 units/yr.	Approximately 600 units were loaded. Operations occurred at both TSFF and WETF.
Gas Analysis: TSTA, TSFF, WETF	Analytical support to current capabilities. Operations estimated to contribute <5% of LANL's tritium emissions to the environment.	Continues at all three facilities. No changes in facility emissions from this activity.
Calorimetry: TSTA, TSFF, WETF	This capability provides a measurement method for tritium material accountability. Contained tritium is placed in the calorimeter for quantity measurements. This capability is used frequently, but contributes <2% of LANL's tritium emissions to the environment.	Continues at WETF and TSFF. No changes in facility emissions from this activity.
Solid Material and Container Storage: TSTA, TSFF, WETF	Storage of tritium occurs in process systems, process samples, inventory for use, and as waste. On-site storage could increase by a factor of 10 over 1995 levels, with most of the increase occurring at WETF.	The storage at TSTA and TSFF remained constant. The storage at WETF has increased by approximately 10% over 1995 levels.

[a] Includes the remodel of Building TA-16-450 to connect it to WETF in support of neutron tube target loading.

TA-21 Tritium Systems Test Assembly and Tritium Science and Fabrication Facility

Weapons Engineering Tritium Facility

Typical glove box operation

2.2.3 Operations Data for the Tritium Facilities

Data for operations at the Tritium Facilities were below levels projected by the ROD. For example, radioactive air emissions totaled approximately 650 curies compared to 2500 curies projected by the ROD, and a total of 37 cubic meters of LLW were generated, compared to 480 projected. Operational data are summarized in Table 2.2.3-1.

Table 2.2.3-1. Tritium Facilities (TA-16 and TA-21)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
TA-16/WETF, Tritium as a gas	Ci/yr	3.00E+2	2.4E+1
TA-16/WETF, Tritium in water vapor	Ci/yr	5.00E+2	1.4E+2
TA-21/TSTA, Tritium as a gas	Ci/yr	1.00E+2	1.7E+1
TA-21/TSTA, Tritium in water vapor	Ci/yr	1.00E+2	4.9E+1
TA-21/TSFF, Tritium as a gas	Ci/yr	6.40E+2	9.2E+1
TA-21/TSFF, Tritium in water vapor	Ci/yr	8.60E+2	3.3E+2
NPDES Discharge: [a]			
Total Discharges	MGY	0.33	8.97
02A129 (TA-21)	MGY	0.11	8.83
03A158 (TA-21) [b]	MGY	0.22	0.14
Wastes:			
Chemical	kg/yr	1700	51.7
LLW	m^3/yr	480	0
MLLW	m^3/yr	3	0
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	123	28 [c]

[a] Outfalls eliminated before 1999: 05S (TA-21), 03A036 (TA-21), 04A091 (TA-16).
[b] This outfall only discharged two quarters during calendar year 1999.
[c] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 3.6, Socioeconomics) is not appropriate.

2.3 Chemistry and Metallurgy Research Building (TA-03)

The CMR Building Key Facility serves as a production, research, and support center for actinide chemistry and metallurgy research and analysis, uranium processing, and fabrication of weapon components. It consists of the main building (TA-3-29) and a pump house for RLW, TA-3-154. The main two-story building has a central corridor and seven wings. It is a Category 2 nuclear facility, primarily because of hot cell activities in Wing 9 and the quantities of nuclear material in the storage vault.

2.3.1 Construction and Modifications at the CMR Building

The ROD projected five facility modifications by December 2005:

- Phase I Upgrades to maintain safe operating conditions for 5 to 10 years;
- Phase II Upgrades (except seismic) to enable operations for an additional 20 to 30 years;
- modifications for production of targets for the molybdenum-99 medical isotope;
- modifications for the recovery of sealed neutron sources; and
- modifications for safety testing of pits in the Wing 9 hot cells.

During1999, there was activity on two of these five, the Phase I Upgrades and the Phase II Upgrades. At the end of 1999, five of the 11 Phase I Upgrades remain to be completed. Projections of completion status for these project activities are shown in Table 2.3.1-1.

Table 2.3.1-1. CMR Upgrade Project/Phase I Status/December 1999

% COMPLETE	STATUS	UPGRADE
100	completed	Continuous air monitors in building wings
80	continuing	Wing electrical systems
70	work stopped[a]	Power distribution system
90	work stopped[a]	Stack monitoring system
90	continuing	Interim improvements to the duct wash down system
40	work stopped[a]	Improvements to acid vents and drains

[a] Work stopped because of a hold put on CMR Phase 1 Upgrades by DOE.

Progress was made on three of the original 13 Phase II Upgrades during 1999. 'Upgrades to the Operations Center' and 'Upgrades to the Fire Protection System' were 25% complete at the end of 1999. The 'Standby Power for the Operations Center' activity was completed in 1999. No work was performed on the remaining 10 Phase II activities.

2.3.2 Operations at the CMR Building

The eight capabilities identified in the SWEIS for the CMR facility are presented in Table 2.3.2-1. For comparison purposes, levels at which these capabilities were operated during 1999 are listed.

Table 2.3.2-1. CMR Building (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Analytical Chemistry	Sample analysis in support of a wide range of actinide research and processing activities. Approximately 7000 samples/yr.	Approximately 2926 samples were analyzed.
Uranium Processing	Activities to recover, process, and store LANL highly enriched uranium inventory by 2005. Includes possible recovery of materials resulting from manufacturing operations.	Activities to recover and process highly enriched uranium were performed. Three shipments to Y-12 involved packaging and re-packaging.
Destructive and Nondestructive Analysis	Evaluate 6 to 10 secondaries/yr through destructive/nondestructive analysis and disassembly.	Performed nondestructive analysis on less than 10 secondaries.
Nonproliferation Training	Nonproliferation training involving SNM. No additional quantities of SNM, but may work with more types of SNM than in 1995.	Five weeks of SNM nonproliferation training conducted. Two weeks involved Category 2 quantities of SNM.
Actinide Research and Processing [b]	Process up to 5000 Ci/yr plutonium-238/beryllium and americium-241/beryllium neutron sources. Process neutron sources other than sealed sources. Stage up to 1000 plutonium-238/beryllium and americium-241/beryllium sources in Wing 9 floor holes.	No source processing activity.
	Introduce research and development effort on spent nuclear fuel related to long-term storage, and analyze components in spent and partially spent fuels.	No activity.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Actinide Research and Processing [b] (Continued)	Metallurgical microstructural/chemical analysis and compatibility testing of actinides and other metals. Primary mission to study long-term aging and other material effects. Characterize about 100 samples/yr. Conduct research and development in hot cells on pits exposed to high temperatures.	Performed microstructural characterization tests on approximately 50 samples containing less than 20 grams of plutonium per sample. No research and development on pits exposed to high temperatures.
	Analysis of TRU waste disposal related to validation of the Waste Isolation Pilot Plant (WIPP) performance assessment models. TRU waste characterization. Analysis of gas generation such as could occur in TRU waste during transportation to WIPP. Performance Demonstration Program to test nondestructive analysis/nondestructive examination equipment. Demonstrate actinide decontamination technology for soils and materials. Develop actinide precipitation method to reduce mixed wastes in LANL effluents.	Final analysis conducted on experiments.
Fabrication and Metallography	Produce 1080 targets/yr, each containing approximately 20 grams uranium-235, for the production of molybdenum-99, plus an additional 20 targets/wk for 12 weeks. Separate fission products from irradiated targets to provide molybdenum-99. Ability to produce 3000 six-day curies of molybdenum-99/wk.[c]	No work performed.
	Support complete highly enriched uranium processing, research and development, pilot operations, and casting. Fabricate metal shapes, including up to 50 sets of highly enriched uranium components, using 1 to 10 kg highly enriched uranium per operation. Material recovered and retained in inventory. Up to 1000 kg annual throughput.	No activity.

[a] Includes completion of Phase I and Phase II Upgrades, except for seismic upgrades, modifications for the fabrication of Molybdenum-99 (Mo-99) targets, modifications for the Radioactive Source Recovery Program, and modification for safety testing of pits.
[b] The actinide activities at the CMR Building and at TA-55 are expected to total 400 kg/yr. The future split between these two facilities is not known, so the facility-specific impacts at each facility are conservatively analyzed at this maximum amount. Waste projections, which are not specific to the facility (but are related directly to the activities themselves), are only projected for the total of 400 kg/yr.
[c] Mo-99 is a radioactive isotope that decays to form metastable Technicium-99, a radioactive isotope that has broad applications in medical diagnostic procedures. Both isotopes are short-lived, with half-lives (the time in which the quantity of the isotope is reduced by 50 percent) of 66 hours and 6 hours, respectively. These short half-lives make these isotopes both attractive for medical use (minimizes the radiation dose received by the patient) and highly perishable. Production of these isotopes is therefore measured in "six-day curies," the amount of radioactivity remaining after six days of decay, which is the time required to produce and deliver the isotope to hospitals and other medical institutions.

2.3.3 Operations Data for the CMR Building

Operations data from research, services, and production activities at the CMR Building were well below those projected by the ROD. Radioactive air emissions were less than one curie (compared to 1645 projected)—principally because processing of irradiated molybdenum-99 targets in the hot cells did not occur in 1999. In addition, only about ten percent of projected LLW were generated. Table 2.3.3-1 provides details of these and other operational data.

Table 2.3.3-1. Chemistry and Metallurgy Research Building (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Total Actinides[a]	Ci/yr	7.60E-4	3.0E-5
Krypton-85	Ci/yr	1.00E+2	Not measured [b]
Xenon-131m	Ci/yr	4.50E+1	Not measured [b]
Xenon-133	Ci/yr	1.50E+3	Not measured [b]
Tritium Water	Ci/yr	Negligible	Not measured [b]
Tritium Gas	Ci/yr	Negligible	Not measured [b]
Technetium-99	Ci/yr	Not projected [c]	9.2E-4
NPDES Discharge:			
03A-021[d]	MGY	0.53	4.45
Wastes:			
Chemical	kg/yr	10,800	6342
LLW	m^3/yr	1820	188.5
MLLW	m^3/yr	19	0.4
TRU/Mixed TRU	m^3/yr	41 [e]	11.1
TRU	m^3/yr	28 [e]	9.2
Mixed TRU	m^3/yr	13 [e]	1.9
Number of Workers	FTEs	367	204 [f]

[a] Includes uranium, plutonium, americium, and thorium.
[b] Potential emissions during the period were sufficiently small that measurement of these radionuclides was not necessary to meet facility or regulatory requirements.
[c] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[d] This outfall discharged all four quarters during calendar year 1999.
[e] The ROD provided the data for TRU and Mixed TRU wastes in Chapter 3 and Chapter 5 of the SWEIS. However, the projections made had to be modified to reflect the decision to produce nominally 20 pits per year.
[f] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.4 Pajarito Site (TA-18)

The Pajarito Site Key Facility is located entirely at TA-18. The facility consists of a main building (18-30), three outlying, remote-controlled critical assembly buildings known as kivas (18-23, -32, -116), and a number of additional support buildings, including the hillside vault (18-26). Principal activities are the design and performance of nuclear criticality experiments and detector development in support of emergency response, nonproliferation, and arms control. This Key Facility has five Category 3 nuclear facilities (the hillside vault for nuclear material storage, two kivas, and two additional research buildings) and one Category 2 nuclear facility (Kiva #2).

2.4.1 Construction and Modifications at the Pajarito Site

The ROD projected replacement of the portable linear accelerator (linac). However, this has not been done, nor did any major modifications or new construction projects occur during 1999.

2.4.2. Operations at the Pajarito Site

The SWEIS identified nine capabilities for this Key Facility. No new research capabilities have been added, and none have been deleted. The TA-18 facility experienced normal operations during 1999 and conducted 188 criticality experiments. This total of 188 experiments is approximately a factor of six below the ROD projection of a maximum of 1050 experiments in any given year. In addition, inventory levels remained essentially constant, and there was not a significant increase in nuclear weapons components and materials at the facility. Table 2.4.2-1 provides details.

Table 2.4.2-1. Pajarito Site (TA-18)/Comparison of Operations

ACTIVITIES	SWEIS ROD[a]	1999 OPERATIONS
Dosimeter Assessment and Calibration	Perform up to 1050 criticality experiments per year.	Performed 188 experiments.
Detector Development	Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR [b] experiments, and materials processing. Increase nuclear materials inventory by 20%, and replace portable linac.	Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999. Did not replace the portable accelerator.
Materials Testing	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing.	Performed 188 experiments.
Subcritical Measurements	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing. Increase nuclear materials inventory by 20%.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999.
Fast-Neutron Spectrum	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing. Increase nuclear materials inventory by 20%, and increase nuclear weapons components and materials.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999. Slight increase in nuclear weapons components and materials in 1998, no additional increase in 1999.
Dynamic Measurements	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing. Increase nuclear materials inventory by 20%.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999.
Skyshine Measurements	Perform up to 1050 criticality experiments per year.	Performed 188 experiments.
Vaporization	Perform up to 1050 criticality experiments per year.	Performed 188 experiments.
Irradiation	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, interrogation techniques, and field systems. Increase nuclear materials inventory by 20%.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999.

[a] Includes replacement of the portable linac. [b] Light detection and ranging.

2.4.3 Operations Data for the Pajarito Site

Research activities were well below those projected by the ROD; consequently, operations data were also well below projections. The chief environmental measure of activities at the Pajarito Site is the estimated radiation dose to a hypothetical member of the public, referred to as the maximally exposed individual (MEI). The dose estimated to result from 1999 activities was 2.6 millirem, compared to 28.5 millirem per year projected by the ROD. Chemical waste generation was below projections (1707 kilograms generated in 1999 compared to 4000 projected). Operational data are detailed in Table 2.4.3-1.

Table 2.4.3-1. Pajarito Site (TA-18)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Argon-41 [a]	Ci/yr	1.02E+2	4.9E-1
External Penetrating Radiation	mrem/yr	28.5 [b]	2.6
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	4000	1707
LLW	m^3/yr	145	31.3
MLLW	m^3/yr	1.5	7.9
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	95	70 [c]

[a] These values are not stack emissions. The SWEIS ROD projections are from Gaussian plume dispersion modeling. Values are from the first 394-foot (120-meter) radius. Other isotopes (nitrogen-13 and oxygen-15) are not shown because of very short half-lives. Values for 1999 were estimated by using Monte Carlo modeling.

[b] Page 5-116, Section 5.3.6.1, "Public Health," of the SWEIS.

[c] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time AND part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

Pajarito Site (TA-18)

Class in criticality

2.5 Sigma Complex (TA-03)

The Sigma Complex Key Facility consists of four principal buildings: the Sigma Building (03-66), the Beryllium Technology Facility (BTF) (03-141), the Press Building (03-35), and the Thorium Storage Building (03-159). Primary activities are the fabrication of metallic and ceramic items, characterization of materials, and process research and development. This Key Facility has two Category 3 nuclear facilities (03-66 and 03-159).

2.5.1 Construction and Modifications at the Sigma Complex

The ROD projected significant facility changes for the Sigma Building itself. Table 2.5.1-1 below indicates that three of five planned upgrades have been completed.

Table 2.5.1-1. Upgrades Planned for Sigma, Building 03-66

DESCRIPTION	COMPLETED?
Seismic upgrades	No
Roof replacement	No [a]
Replacement of graphite collection systems	Yes—1998
Modification of the industrial drain system	Yes—1998
Replacement of electrical components	Yes—1999

[a] Largely completed in 1998; continued into 1999.

In addition, although operations have not yet started, construction of the BTF, formerly known as the Rolling Mill Building, was completed during 1999. The BTF, a state-of-the-art beryllium processing facility, has 16,000 square feet of floor space, of which 13,000 are used for beryllium operations. The remaining 3000 square feet will be used for general metallurgical activities. Mission of the new facility is to maintain and enhance the beryllium technology base that exists at LANL, and to establish the capability for fabrication of beryllium powder components. Research will also be conducted at the BTF, and will include energy and weapons-related use of beryllium metal and beryllium oxide. As discussed in Section 2.8, Machine Shops, beryllium equipment will be moved from the shops into the BTF in stages, and the move should be completed in 2000.

2.5.2 Operations at the Sigma Complex

The SWEIS identified three capabilities for the Sigma Complex. No new capabilities have been added, and none have been deleted. As indicated in Table 2.5.2-1, activity levels for all capabilities were less than levels projected by the ROD.

Table 2.5.2-1. Sigma Complex (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Research and Development on Materials Fabrication, Coating, Joining, and Processing	Maintain and enhance capability to fabricate items from metals, ceramics, salts, beryllium, enriched uranium, depleted uranium, and other uranium isotope mixtures including casting, forming, machining, polishing, coating, and joining.	Capability maintained and enhanced, as projected.
Characterization of Materials	Maintain and enhance research and development activities on properties of ceramics, oxides, silicides, composites, and high-temperature materials. Characterize components for accelerator production of tritium.	Modest increase in research and development. Totals of 248 jobs and 1300 specimens.
	Analyze up to 36 tritium reservoirs/yr.	Less than 36 tritium reservoirs analyzed.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Characterization of Materials (Continued)	Develop library of aged non-SNM materials from stockpiled weapons and develop techniques to test and predict changes. Store and characterize up to 2500 non-SNM component samples, including uranium.	Approximately 500 non-SNM materials samples and 500 non-SNM component samples stored in library.
Fabrication of Metallic and Ceramic Items	Fabricate stainless steel and beryllium components for about 80 pits/yr.	No development pits fabricated.
	Fabricate up to 200 tritium reservoirs per year.	Less than 200 tritium reservoirs fabricated.
	Fabricate components for up to 50 secondaries per year.	Fabricated components for less than 50 secondaries.
	Fabricate nonnuclear components for research and development: about 100 major hydrotests and 50 joint test assemblies/yr.	Fabricated components for less than 100 major hydrotests and for less than 50 joint test assemblies.
	Fabricate beryllium targets.	None produced.
	Fabricate targets and other components for accelerator production of tritium research.	Three radiofrequency cavities produced.
	Fabricate test storage containers for nuclear materials stabilization.	None produced.
	Fabricate nonnuclear (stainless steel and beryllium) components for up to 20 pit rebuilds/yr.	Fabricate nonnuclear (stainless steel and beryllium) components for less than 20 pit rebuilds/yr.

[a] Includes Sigma Building renovation and modifications for BTF.

2.5.3 Operations Data for the Sigma Complex

Levels of research and operations were less than those projected by the ROD; consequently, operations data were also below projections. Waste volumes, radioactive air emissions, and NPDES discharge volumes were all lower than projected by the ROD. Table 2.5.3-1 provides details.

Table 2.5.3-1. Sigma Complex (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:[a]			
Uranium-234	Ci/yr	6.60E-5	1.2E-6
Uranium-235	Ci/yr	Not projected [b]	4.5E-8
Uranium-238	Ci/yr	1.80E-3	1.3E-8
Thorium-230	Ci/yr	Not projected [b]	6.4 E-9
NPDES Discharge:			
Total Discharges	MGY	7.3	5.77
03A-022 [c]	MGY	4.4	5.77
03A-024	MGY	2.9	No discharge
Wastes:			
Chemical	kg/yr	10,000	3,208
LLW	m^3/yr	960	61
MLLW	m^3/yr	4	0.3
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	284	101 [d]

[a] Only emissions from TA-3-35 were measured using stack sampling. Potential emissions from other Sigma facilities were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.

(continued)

[b] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[c] This outfall discharged all four quarters during calendar year 1999.
[d] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.6 Materials Science Laboratory (TA-03)

The MSL Key Facility is a single laboratory building (03-1698) containing 27 labs, 60 offices, 21 materials research areas, and support rooms. The building, a two-story structure with approximately 55,000 square feet of floor space, was first opened in November 1993. Activities are all related to research and development of materials science. This Key Facility is categorized as a Low Hazard nonnuclear facility.

2.6.1 Construction and Modifications at the MSL

There were no facility modifications during 1999. As indicated in the SWEIS, completion of the second floor is under consideration, but has not yet been funded.

2.6.2 Operations at the MSL

The SWEIS identified four major types of experimentation at MSL: materials processing, mechanical behavior in extreme environments, advanced materials development, and materials characterization. No new capabilities have been added, and none have been deleted. In 1999, similar to 1998, MSL conducted operations at levels approximating those projected in the ROD. This is not surprising since MSL is a new facility that responds to the variability of research and development funding.

There were approximately 105 researchers and support staff at MSL, about 30% more than the 82 projected by the ROD. (The primary measurement of activity for this facility is the number of scientists doing research.) This increase was accomplished by having researchers share offices and labs and reflects the high value placed on the MSL because of its quality lab space. Table 2.6.2-1 compares 1999 operations to projections made by the ROD.

Table 2.6.2-1. MSL (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Materials Processing	Maintain seven research capabilities at 1995 levels: • Wet chemistry • Thermomechanical processing • Microwave processing • Heavy equipment materials • Single crystal growth • Amorphous alloys • Powder processing Expand materials synthesis/processing to develop cold mock-up of weapons assembly and processing. Expand materials synthesis/processing to develop environmental and waste technologies.	These capabilities were maintained as projected in the ROD.
Mechanical Behavior in Extreme Environment	Maintain two research capabilities at 1995 levels: • Mechanical testing • Fabrication and assembly Expand dynamic testing to include research and development for the aging of weapons materials. Develop a new research capability (machining technology).	Mechanical testing was maintained as projected. Research into materials failure and fracture continued.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Advanced Materials Development	Maintain four research capabilities at 1995 levels of research: • New materials • Synthesis and characterization • Ceramics • Superconductors	This capability was maintained as projected in the ROD.
Materials Characterization	Maintain four research capabilities at 1995 levels: • Surface science chemistry • X-ray • Optical metallography • Spectroscopy Expand corrosion characterization to develop surface modification technology. Expand electron microscopy to develop plasma source ion implantation.	Materials characterization continued to be maintained.

[a] Includes completion of the second floor of MSL.

2.6.3 Operations Data for the MSL

The overall size of the MSL workforce has increased from approximately 80 workers in 1995 to about 105 in 1999 (including visiting staff, contractors, and others not included in the regular part-time and full-time LANL employees listed in Table 2.6.3-1) and significantly exceeds the workforce of 82 projected by the ROD. The operational effects of this increased workforce and of increased activity, however, have been smaller than projected. Waste quantities were lower than projected, and radioactive air emissions continue to be negligible and therefore were not measured. Table 2.6.3-1 provides details.

Table 2.6.3-1. MSL (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions	Ci/yr	Negligible	Not measured
NPDES Discharge Volume	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	600	154
LLW	m^3/yr	0	0
MLLW	m^3/yr	0	0
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	82	57 [a]

[a] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.7 Target Fabrication Facility (TA-35)

The TFF is a two-story building (35-213) housing activities related to weapons production and laser fusion research. This Key Facility is categorized a Low Hazard chemical facility. Exhaust air from process equipment is filtered before exhausting to the atmosphere. Sanitary wastes are piped to the LANL sewage facility at TA-46, and RLW is piped to the treatment facility at TA-50.

2.7.1 Construction and Modifications at the Target Fabrication Facility

The ROD did not project any facility changes through 2005, and there were none during 1999.

2.7.2 Operations at the Target Fabrication Facility

The SWEIS identified three capabilities for the TFF Key Facility. No new capabilities have been added, and none have been deleted. The primary measurement of activity for this facility is production of targets for research and testing (laser and physics testing). In 1999, approximately 1200 targets and specialized components were fabricated for testing purposes, which is less than the 6100 targets per year projected by the ROD. As seen in the Table 2.7.2-1, other operations at the TFF were also below levels projected by the ROD.

Table 2.7.2-1. Target Fabrication Facility (TA-35)/Comparison of Operations

CAPABILITY	SWEIS ROD	1999 OPERATIONS
Precision Machining and Target Fabrication	Provide targets and specialized components for about 6100 laser and physics tests/yr, including a 20% increase over 1995 levels in high-explosive pulsed-power target operations, and including about 100 high-energy-density physics tests.	Provided targets and specialized components for about 1200 tests. Supported high-explosive pulsed-power tests at 1995 levels. Supported about 25 high-energy-density physics tests.
Polymer Synthesis	Produce polymers for targets and specialized components for about 6100 laser and physics tests/yr, including a 20% increase over 1995 levels in high-explosive pulsed-power target operations, and including about 100 high-energy-density physics tests.	Produced polymers for targets and specialized components for about 600 tests. Supported high-explosive pulsed-power tests at 1995 levels. Supported about 20 high-energy-density physics tests.
Chemical and Physical Vapor Deposition	Coat targets and specialized components for about 6100 laser and physics tests/yr, including a 20% increase over 1995 levels in high-explosive pulsed-power target operations, including about 100 high-energy-density physics tests, and including support for pit rebuild operations at twice 1995 levels.	Coated targets and specialized components for about 600 tests. Supported high-explosives pulsed-power tests at 1995 levels. Supported about 25 high-energy-density physics tests. Provided coatings for pit rebuild operations.

2.7.3 Operations Data for the Target Fabrication Facility

TFF activity levels are primarily determined by funding from fusion, energy, and other research-oriented programs, as well as funding from some defense-related programs. These programs, and hence operations at TFF, were at levels similar to those in 1995 and below levels projected by the ROD. This summary is supported by the current workforce, which is the same size as in 1995, and by 1999 waste volumes, which were less than projected. Table 2.7.3-1 details operations data for 1999.

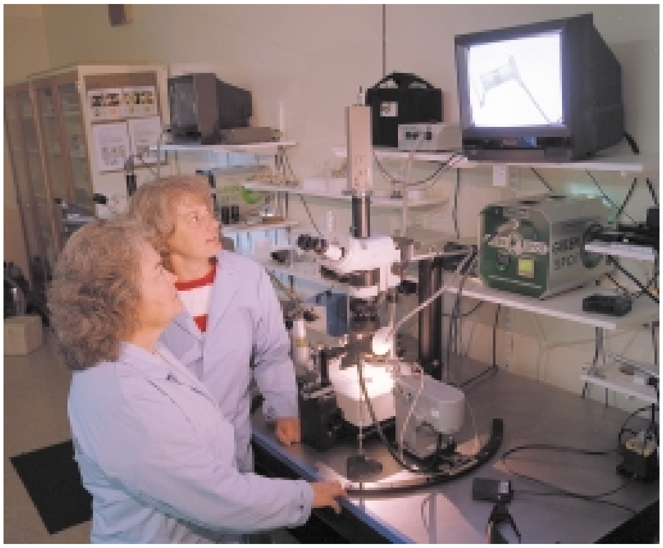

Table 2.7.3-1. Target Fabrication Facility (TA-35)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radiological Air Emissions	Ci/yr	Negligible	Not measured [a]
NPDES Discharge: [b]	No discharge	0	No outfalls
Wastes:			
Chemical	kg/yr	3800	595
LLW	m^3/yr	10	0
MLLW	m^3/yr	0.4	0
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	98	54 [c]

[a] Potential emissions during the period were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.
[b] Outfalls eliminated before 1999: 04A127 (TA-35)
[c] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 3.6, Socioeconomics) is not appropriate.

2.8 Machine Shops (TA-03)

The Machine Shops Key Facility consists of two buildings, the Beryllium Shop (Building 03-39) and the Uranium Shop (Building 03-102). Activities consist of machining and fabrication of various materials in support of major LANL operations, principally those related to the processing and testing of high explosives and weapons components. Building 03-39 is categorized as a Low Hazard chemical facility, attributed in part to beryllium operations, while Building 03-102 is categorized as a Low Hazard radiological facility, because of uranium operations.

2.8.1 Construction and Modifications at the Machine Shops

There was no new construction or major modifications to the shops in 1999. In the future, beryllium equipment will be moved from Room 16 in the north wing of Building 03-39 to Building 03-141, the BTF (part of the Sigma Key Facility). The move will be conducted in phases and should be completed in the year 2000.

2.8.2 Operations at the Machine Shops

As shown in Table 2.8.2-1, the SWEIS identified three major capabilities at the shops. These same three capabilities continue to be maintained to support customers at LANL. No new capabilities have been added to this Key Facility, and none have been deleted. All activities occurred at levels well below those projected by the ROD. The workload at the Shops is directly linked with high explosives testing and processing operations. Much of the effort of staff for high explosive testing and processing in 1999 was directed to the development and construction of the Dual-Axis Radiographic Hydrodynamic Test (DARHT) facility. This resulted in a significant decrease in high explosive testing and production, and subsequently, a significant reduction in workload for the Shops.

Machine Shops showing numerical-controlled machines

Table 2.8.2-1. Machine Shops (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD	1999 OPERATIONS
Fabrication of Specialty Components	Provide fabrication support for the dynamic experiments program and explosives research studies. Support up to 100 hydrodynamic tests/yr. Manufacture up to 50 joint test assembly sets/yr. Provide general laboratory fabrication support as requested.	Specialty components were fabricated at levels far below those projected in the SWEIS ROD.
Fabrication Utilizing Unique Materials	Continue fabrication utilizing unique and unusual materials.	Fabrication with unique materials was conducted at levels far below those projected by the SWEIS ROD.
Dimensional Inspection of Fabricated Components	Provide appropriate dimensional inspection of above fabrication activities. Undertake additional types of measurements/inspections.	Dimensional inspection was provided for the above fabrication activities. Additional types of measurements and inspections were not undertaken.

2.8.3 Operations Data for the Machine Shops

Since activities were well below projections by the ROD, so too were operations data. Chemical waste generation was less than 0.1% of projected generation (3955 kilograms generated in 1999, compared to a ROD projection of 474,000 kilograms per year). Table 2.8.3-1 provides details.

Table 2.8.3-1. Machine Shops (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Thorium-228	Ci/yr	Not projected [a]	2.5E-9
Thorium-230	Ci/yr	Not projected [a]	7.8E-10
Thorium-232	Ci/yr	Not projected [a]	5.4E-10
Uranium-234	Ci/yr	Not projected [a]	3.0E-7
Uranium-235	Ci/yr	Not projected [a]	1.2E-8
Uranium-238	Ci/yr	1.50E-4	1.3E-8
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	474,000	3955
LLW	m^3/yr	606	40.4
MLLW	m^3/yr	0	0.03
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	289	81 [b]

[a] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.

[b] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (full-time and part-time regular). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.9 High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, TA-37)

The High Explosives Processing Key Facility is located in all or parts of seven TAs. Building types consist of production and assembly facilities, analytical laboratories, explosives storage magazines, and a facility for the treatment of high explosive contaminated wastewaters. Activities consist primarily of the manufacture and assembly of high explosives components for nuclear weapons and for Science-Based Stockpile Stewardship Program tests and experiments. Production activities are centered in buildings at TA-16, TA-09, and TA-22. Environmental and safety tests are performed at TA-11 and TA-09 while TA-08 houses radiography activities. This Key Facility has four Category 2 nuclear buildings in TA-08 (08-22, -23, -24, -70) and no Category 3 nuclear or Moderate Hazard nonnuclear facilities.

Operations at this Key Facility are performed by two separate Divisions: the Dynamic Experimentation (DX) Division and the Engineering Sciences and Applications (ESA) Division. As a result, information from both Divisions must be combined to completely capture operational parameters for this Key Facility.

2.9.1 Construction and Modifications at High Explosives Processing

The ROD projected four facility modifications for this Key Facility. All four projects were completed before 1999.

Facility changes that occurred during 1999 are described below.

(a) At TA-9, an above ground wastewater storage tank system was placed into service on December 17, 1999. This system collects wastewater that is then moved by truck to the High Explosive Wastewater Treatment Facility (HEWTF) TA-16 for treatment. This project is covered by a separate NEPA document (LANL 1998b).

(b) The real time, small component radiography capability installed in building TA-16-260 was not made fully operational in 1999. When this capability becomes fully operational, buildings TA-16-220, -222, -223, -224, -225, and -226 will be vacated (DOE 1997a).

(c) Planning and modification work at TA-9 has continued to allow consolidation of high explosives formulation operations previously conducted at TA-16-340 with other TA-9 high explosives operations. Closure of building TA-16-340 will follow in fiscal year 2000 (DOE 1999c).

(d) In 1999, explosives stored at TA-28 were moved to TA-37 for storage. Although TA-28 is no longer used for storage, it remains part of the High Explosives Processing Key Facility.

2.9.2 Operations at High Explosives Processing

The ROD identified six capabilities for this Key Facility. No new capabilities have been added, and none have been deleted. Activity levels during 1999 continued below those projected by the ROD. These projections were based on the possibility that LANL would take over high explosives production work being performed at Pantex Plant. DOE has decided, however, to keep high explosives production at the Pantex Plant.

As seen in Table 2.9.2-1, high explosives and plastics development and characterization operations remained below levels projected in the SWEIS ROD. Considerable effort was expended during 1999 in continued development of protocols for obtaining stockpile returned materials, developing new test methods, and procuring new equipment to support requirements for science-based studies on stockpile materials.

Typical nonnuclear high explosive test

Table 2.9.2-1. High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, and TA-37)/Comparison of Operations

CAPABILITY	SWEIS ROD[a, b]	1999 OPERATIONS
High Explosives Synthesis and Production	Continue synthesis research and development, produce new materials, and formulate explosives as needed. Increase production of materials for evaluation and process development. Produce material and components for directed stockpile production.	The high explosives synthesis and production operations were less than those projected by the SWEIS ROD.
High Explosives and Plastics Development and Characterization	Evaluate stockpile returns. Increase (40%) efforts in development and characterization of new plastics and high explosives for stockpile improvement. Improve predictive capabilities. Research high explosives waste treatment methods.	High explosives formulation, synthesis, production, and characterization operations were performed at levels that were less than those projected by the SWEIS ROD.
High Explosives and Plastics Fabrication	Continue traditional stockpile surveillance and process development. Supply parts to Pantex for surveillance, stockpile rebuilds, and joint test assemblies. Increase fabrication for hydrodynamic and environmental testing.	DX Division fabricated approximate 3000 high explosive parts, and ESA Division fabricated approximately 870 high explosives parts in 1999. Therefore, approximately 3870 parts were fabricated in support of the weapons program including high explosives characterization studies, subcritical experiments, hydrotests, surveillance activities, environmental weapons tests, and safety tests.
Test Device Assembly	Increase test device assembly to support stockpile related hydrodynamic tests, joint test assemblies, environmental and safety tests, and increased research and development. Approximately 100 major assemblies per year.	ESA Division provided 10 major assemblies for hydrodynamic, Nevada Test Site subcritical, and joint environmental test programs.
Safety and Mechanical Testing	Increase (50%) safety and environmental tests related to stockpile assurance. Improve predictive models. Approximately 15 safety and mechanical tests per year.	DX Division performed 13 stockpile related safety and mechanical tests during 1999. ESA Division provided three re-validation and two certification assemblies in 1999.
Research, Development, and Fabrication of High-Power Detonators	Increase operations to support assigned stockpile stewardship management activities; manufacture up to 40 major product lines per year. Support DOE complex for packaging and transportation of electro-explosive devices.	High-power detonator activities by DX Division resulted in the manufacture of 20 product lines in 1999. In addition, ESA Division provided fourteen flux generator assemblies in 1999.

[a] The total amount of explosives and mock explosives used across all activities is an indicator of overall activity levels for this Key Facility. Amounts projected by the ROD are 82,700 pounds of explosives and 2910 pounds of mock explosives. Actual amounts used in 1999 were 15,150 pounds of high explosive (DX Division, 8150 pounds and ESA Division, 7000 pounds), and 5279 pounds of mock high explosive (DX Division, 1750 pounds and ESA Division, 3529 pounds).

[b] Includes construction of the HEWTF, the steam plant conversion, relocation of the Weapons Testing Facility, and outfall modifications.

In 1999, 15,664 pounds of high explosives and 5279 pounds of inert mock high explosives material were used. The level of high explosives usage was significantly below the ROD projection of 82,700 pounds of high explosives, while the usage of mock high explosives was almost twice the projection of 2910 pounds. However, the mock high explosive results in chemical waste that is shipped off-site for disposal and does not result in environmental impacts at LANL.

At the TA-16 Burn Ground, 5225 pounds of high explosives-contaminated materials were flashed, and 7514 pounds of high explosives and 3080 pounds of oil/solvent were open air burned. The HEWTF processed 95,778 gallons of high explosives-contaminated water. Again, these levels were well below those projected by the ROD. Three outfalls from High Explosives Processing remain on the NPDES permit: 03A130, 05A055 (the HEWTF), and 05A097.

Drill press used for machining high explosives

2.9.3 Operations Data for High Explosives Processing

The details of operations data are provided in Table 2.9.3-1. NPDES discharge volume was 118,000 gallons, compared to a projection of 12 million gallons. Waste quantities were similar to projections made by the ROD. Chemical waste volumes were slightly above projections; however, since chemical wastes are shipped off-site for disposal, this is not significant.

Table 2.9.3-1. High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, and TA-37)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Uranium-238	Ci/yr	9.96E-7	[a]
Uranium-235	Ci/yr	1.89E-8	[a]
Uranium-234	Ci/yr	3.71E-7	[a]
NPDES Discharge: [b]			
Number of outfalls		22	3
Total Discharges	MGY	12.4	0.118
03A130 (TA-11) [c]	MGY	0.04	0.022
05A055 (TA-16)	MGY	0.13	0.096
05A097 (TA-11)	MGY	0.01	No discharge
Wastes:			
Chemical	kg/yr	13,000	13,329
LLW	m^3/yr	16	8.3
MLLW	m^3/yr	0.2	0
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	335	96 [d]

[a] No stacks require monitoring; all non-point sources are measured using ambient monitoring.

[b] Outfalls eliminated before 1999: 02A007 (TA-16), 04A070 (TA-16), 04A083 (TA-16), 04A092 (TA-16), 04A115 (TA-8), 04A157 (TA-16), 05A053 (TA-16), 05A056 (TA-16), 05A066 (TA-9), 05A067 (TA-9), 05A068 (TA-9), 05A069 (TA-11), 05A071 (TA-16), 05A072 (TA-16), 05A096 (TA-11), 06A073 (TA-16), 06A074 (TA-8), and 06A075 (TA-8).

[c] This outfall discharged only one quarter during calendar year 1999.

[d] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (full-time and part-time regular). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.10 High Explosives Testing (TA-14, TA-15, TA-36, TA-39, TA-40)

The High Explosives Testing Key Facility is located in all or parts of five TAs, comprises about one-third of the land area occupied by LANL, and has 13 associated firing sites. All firing sites are in remote locations and/or within canyons. Major buildings are located at TA-15 and include the DARHT facility (Building TA-15-312), PHERMEX (TA-15-184), and the TA-15-306 firing site supporting the Ector Multidiagnostic Hydrodynamic Test Facility. Building types consist of preparation and assembly facilities, bunkers, analytical laboratories, explosives storage magazines, and offices. Activities consist primarily of testing high explosives components for nuclear weapons and for Science-Based Stockpile Stewardship Program tests and experiments. This Key Facility has no Category 2 or Category 3 nuclear buildings and no Moderate Hazard nonnuclear facilities.

2.10.1 Construction and Modifications at High Explosives Testing

Construction of DARHT, the only high explosive testing facility projected for construction or modification by the ROD, continued. This facility was evaluated in a separate environmental impact statement (DOE 1995). Installation and component testing of the accelerator and its associated control and diagnostics systems began in 1999.

The Applied Research Optics Electronics Laboratory (TA-15-494) was also under construction in 1999. This is a new office and laboratory building with an adjacent parking lot to consolidate and upgrade existing computer operations at TA-15 and to provide space for visiting scientists. This project has a NEPA categorical exclusion (LANL 1998c).

In addition, outfall 06A106 located at TA-36 was eliminated from the NPDES permit during 1999.

2.10.2 Operations at High Explosives Testing

The ROD identified seven capabilities for this Key Facility. None of these have been deleted, and no new capabilities have been introduced. Levels of research were below those predicted by the ROD and, for some capabilities, below research levels of prior years. Table 2.10.2-1 identifies the operational capabilities discussed in the SWEIS and presents 1999 operational data for comparative purposes. The total amount of depleted uranium expended during testing (all capabilities) is an indicator of overall activity levels at this Key Facility. A total of 67 kilograms were expended in 1999, compared to approximately 3900 kilograms projected by the ROD.

Table 2.10.2-1. High Explosives Testing (TA-14, TA-15, TA-36, TA-39, and TA-40)/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Hydrodynamic Tests	Conduct up to 100 hydrodynamic tests/yr. Develop containment technology. Conduct baseline and code development tests of weapons configuration. Depleted uranium use of 6900 lb/yr (over all activities).	Hydrodynamic tests were conducted in 1999 at a level far below those projected in the SWEIS
Dynamic Experiments	Conduct dynamic experiments to study properties and enhance understanding of the basic physics of state and motion for materials used in nuclear weapons including some experiments with SNM.	Dynamic experiments were conducted at a level far below those projected in the SWEIS
Explosives Research and Testing	Conduct high explosives tests to characterize explosive materials.	Explosives research and testing were conducted at a level far below those projected in the SWEIS
Munitions Experiments	Continued support of Department of Defense in conventional munitions. Conduct experiments with projectiles and study other effects on munitions.	Munitions experiments were conducted at a level far below those projected in the SWEIS

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
High-Explosives Pulsed-Power Experiments	Conduct experiments and development tests.	Experiments were conducted at a level far below those projected in the SWEIS
Calibration, Development, and Maintenance Testing	Conduct tests to provide calibration data, instrumentation development, and maintenance of image processing capability.	Calibration, development, and maintenance testing were conducted at a level far below those projected in the SWEIS
Other Explosives Testing	Develop advanced high explosives or weapons evaluation techniques.	Other explosives testing were conducted at a level far below those projected in the SWEIS

[a] Includes completion of construction for the DARHT facility and its operation.

2.10.3 Operations Data for High Explosives Testing

Much staff effort for high explosives processing and testing in 1999 was directed to the development and construction of DARHT. This resulted in a significant decrease in high explosives testing and production operations from historical levels. As a result, and as presented in Table 2.10.3-1, operations data indicate that materials used and the effects of research during 1999 were considerably less than projections made by the ROD. For example, only 1015 kilograms of chemical waste were generated in 1999 compared to a projected 35,300 kilograms per year. Only 0.01 cubic meters of LLW was generated compared to the projection of 940 cubic meters. In addition, no other radioactive wastes (MLLW, TRU wastes, or mixed TRU wastes) were generated in 1999.

Table 2.10.3-1. High Explosives Testing (TA-14, TA-15, TA-36, TA-39, and TA-40) Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Depleted Uranium	Ci/yr	1.5E-1 [a]	[b]
Chemical Usage: [c]			
Aluminum [d]	kg/yr	45,450	688
Beryllium	kg/yr	90	0.5
Copper [d]	kg/yr	45,630	41
Depleted Uranium	kg/yr	3930	67
Lead	kg/yr	240	0.5
Tantalum	kg/yr	300	0.2
Tungsten	kg/yr	300	0
NPDES Discharge:			
Number of outfalls [e]	----	14	2
Total Discharges	MGY	3.6	14.23
03A028 (TA-15) [f]	MGY	2.2	2.81
03A185 (TA-15) [g]	MGY	0.73	11.42
Wastes:			
Chemical	kg/yr	35,300	1015
LLW	m^3/yr	940	0.01
MLLW	m^3/yr	0.9	0
TRU/Mixed TRU [h]	m^3/yr	0.2	0
Number of Workers	FTEs	619	227[i]

[a] The isotopic composition of depleted uranium is approximately 99.7% uranium-238, approximately 0.3% uranium-235, and approximately 0.002% uranium-234. Because there are no historic measurements of emissions from these sites, projections are based on estimated release fractions of the materials used in tests.

(Continued)

[b] No stacks require monitoring; all non-point sources are measured using ambient monitoring. During 1999, a total of 67 kg of depleted uranium was expended during these activities.
[c] Usage listed for the SWEIS ROD includes projections for expanded operations at DARHT as well as the other TA-15 firing sites (the highest foreseeable level of such activities that could be supported by the LANL infrastructure). No proposals are currently before DOE to exceed the material expenditures at DARHT that are evaluated in the DARHT Environmental Impact Statement (DOE 1995).
[d] The quantities of copper and aluminum involved in these tests are used primarily in the construction of support structures. These structures are not expended in the explosive tests, and thus, do not contribute to air emissions.
[e] Outfalls eliminated before 1999: 04A101 (TA-40), 04A139 (TA-15), 04A141 (TA-39), 04A143 (TA-15), 04A156 (TA-39), 06A080 (TA-40), 06A081 (TA-40), 06A082 (TA-40), 06A099 (TA-40), and 06A123 (TA-15).
[f] This outfall discharged during three quarters of calendar year 1999. The annual quantity of discharge was calculated by using the average daily flow and multiplying by 365 days in the year; this results in an overestimate of volume.
[g] This outfall discharged during all four quarters of calendar year 1999. The annual quantity of discharge was calculated by using the average daily flow and multiplying by 365 days in the year; this results in an overestimate of volume.
[h] TRU waste (steel) will be generated as a result of DARHT's Phased Containment Option (see DARHT Environmental Impact Statement [DOE 1995]).
[i] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (full-time and part-time regular). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.11 Los Alamos Neutron Science Center (TA-53)

The LANSCE Key Facility lies entirely within TA-53. The facility has more than 400 buildings, including one of the largest at LANL. Building 53-03 houses the linac. Activities consist of neutron science research, the development of accelerators and diagnostic instruments, and the production of medical radioisotopes. The majority of the LANSCE Key Facility is composed of the 800-MeV linac, a Proton Storage Ring, and three experimental areas: the Manuel Lujan Neutron Scattering Center, the Weapons Neutron Research (WNR) facility, and Experimental Areas A/B/C. Experimental Area C is the location of proton radiography experiments for the Stockpile Stewardship Program. Experimental Area A, formerly used for materials irradiation experiments and isotope production, is currently inactive, and a new isotope production facility will be constructed at Experimental Area A in the near future. Construction of a second accelerator, the Low-Energy Demonstration Accelerator (LEDA), began in 1997. LEDA is currently in the commissioning phase.

This Key Facility has two Category 3 nuclear activities, experiments using neutron scattering by actinides in Experimental Areas ER-1 and ER-2 (Buildings 53-07 and 53-30) and the 1L neutron production target (Building 53-07). There are no Category 2 nuclear facilities and no Moderate Hazard nonnuclear facilities at TA-53.

2.11.1 Construction and Modifications at LANSCE

The ROD projected significant facility changes and expansion to occur at LANSCE by December 2005. Table 2.11.1-1 below indicates that one project has been completed and that two have been started.

Table 2.11.1-1. Status of Projected Facility Changes at LANSCE

DESCRIPTION	SWEIS REF.	COMPLETED?
Closure of two former sanitary lagoons	2-88-R	Started [a]
LEDA to become operational in late 1998	2-89-R	Yes - 1999 [b]
Short-Pulse Spallation Source enhancements	2-90-L	Started [c]
One-MW target/blanket	2-91-L	No
New 100-MeV Isotope Production Facility	2-92-L	No [d]
Long-Pulse Spallation Source (LPSS), including decontamination and renovation of Area A	3-25-L	No
Dynamic Experiment Lab	3-25-R	No [e]
Los Alamos International Facility for Transmutation (LIFT)	3-25-R	No
Exotic Isotope Production Facility	3-27-L	No
Decontamination and renovation of Area A-East	3-27-L	No

[a] Remediation started in 1999.
[b] LEDA started high-power conditioning of the radio-frequency quadrupole power supply in November 1998. It has been designed for a maximum energy of 12 MeV, not the 40 MeV projected by the ROD. The first trickle of proton beam was produced in March 1999. Maximum power was achieved in September 1999.

(Continued)

[c] Part of the Short-Pulse Spallation Source upgrades have been performed. Upon completion, the project will upgrade the Proton Storage Ring to 200 microamperes and 30 hertz (vs. 70 microamperes and 20 hertz in 1995); will increase the Lujan spallation target power to 160 KW (vs. 55 KW in 1995); and will add five neutron-scattering instruments. Through the end of 1998, the first phase of the Proton Storage Ring upgrade had been completed. Installation of new instruments began in 1999. The complete upgrade is expected in 2002.

[d] Preparations began in the spring of 1999 for construction of the new 100-MeV Isotope Production Facility. Construction started in 2000.

[e] The Stockpile Stewardship Program is currently using Experimental Area C, Building 53-03P, for proton radiography, and the Blue Room, in Building 53-07 for neutron resonance spectroscopy. The concept of combining these experiments in a new Dynamic Experiment Laboratory has not yet materialized.

In addition to these projected construction activities, a new RLW treatment facility was constructed during 1999 and began treating water in December 1999. RLW comes primarily from floor drains and accelerator and magnet cooling water. Water flows by gravity into lift stations constructed adjacent to Experimental Area A (Building 53-03M) and the Lujan Center (Building 53-07). The RLW is pumped from the lift stations through double-walled piping to one of three 30,000-gallon horizontal fiber glass tanks located in new Building 53-945 at the east end of TA-53. The tanks are sized to allow decay of radioisotopes generated by the LANSCE accelerator beam, most of which have short half-lives. After aging, the RLW is pumped to one (the western) of two evaporative basins. Each of the basins is above ground, 75 feet by 75 feet by 3 feet in dimension, with a capacity to hold 125,000 gallons of water. Basins are concrete, have a nonpermeable liner, and are instrumented to detect leaks. In the event of extremely high RLW generation rates, the west basin would overflow to the east basin. The basins are sized, however, such that the east basin is not likely to ever be used.

2.11.2 Operations at LANSCE

The SWEIS identified seven capabilities for the LANSCE Key Facility. No new capabilities have been added, and none have been deleted. LANSCE operated the Lujan Center and the WNR facility in mid-January 1999 through early February 1999; then went into stand-down. WNR came back on-line in mid-summer and ran through the end of the year, while the Lujan Center stayed off-line for the remainder of the year.

The primary indicator of activity for this facility is production of the 800-MeV LANSCE proton beam. In 1999, H^+ beam was not produced. H^- beam was delivered as follows:

(a) to the Lujan Center for 239 hours at an average current of 93 microamperes,

(b) to WNR Target 2 for 587 hours in a "pulse on demand" mode of operation, with average current too small to measure,

(c) to WNR Target 4 for 1993 hours at an average current of five microamperes, and

(d) through Line X to Lines B and C in a "pulse on demand" mode of operation, with average current too small to measure.


Aerial view of TA-53

These production figures are all less than the 6400 hours at 1250 microamperes projected by the ROD. In turn, the reduced beam time meant that those activities reliant upon the 800-MeV beam also were conducted at lower levels. These activities include experiments using neutrons and weapons-related experiments using either protons or neutrons. In addition, there were no experiments conducted for transmutation of wastes. There was also no production of medical isotopes during 1999, although plans for the new Isotope Production Facility neared completion by the end of the year. Table 2.11.2-1 provides details.

Table 2.11.2-1. LANSCE/Comparison of Operations

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Accelerator Beam Delivery, Maintenance, and Development	Deliver LANSCE linac beam to Areas A, B, C, WNR facility, Manuel Lujan Center, Dynamic Experiment Facility, and new isotope production facility for 10 months/yr (6400 hrs). Positive ion current 1250 microampere and negative ion current of 200 microampere.	There was no positive ion beam in 1999. Negative ion beam delivered, at maximum current of 93 microamperes, to Lines B and C (505 hours), WNR facility (1993 hours), and Lujan Center (239 hours). Area A did not receive beam.
	Reconfigure beam delivery and support equipment to support new facilities, upgrades, and experiments.[a]	No major upgrades to the beam delivery complex.
	Commission/operate/maintain LEDA for 10 to 15 yrs; operate up to approximately 6600 hrs/yr.	Full power (100 milliamps and 6.7 MeV) achieved in September 1999.
Experimental Area Support	Full-time remote handling and radioactive waste disposal capability required during Area A interior modifications and Area A-East renovation.	Full-time capability maintained. (Note: Modifications and renovations were not undertaken, however.)
	Support of experiments, facility upgrades, and modifications.	Support activities conducted, per projections of the SWEIS ROD.
	Increased power demand for LANSCE linac and LEDA radio-frequency operation.	A 700-MHz klystron was developed for use with LEDA.
Neutron Research and Technology [b]	Conduct 1000 to 2000 experiments/yr using Manuel Lujan Center, WNR facility, and LPSS. Establish LPSS in Area A (requires modification).	A far fewer number of experiments, since the Lujan Center was idle from February into July. LPSS was not constructed.
	Construct Dynamic Experiment Laboratory adjacent to WNR Facility. Support contained weapons-related experiments: - With small quantities of actinides, high explosives, and sources (up to approximately 80/yr) - With nonhazardous materials and small quantities of high explosives (up to approximately 200/yr) - With up to 4.5 kg high explosives and/or depleted uranium (up to approximately 60/yr) - Shock wave experiments involving small amounts, up to (nominally) 50 grams plutonium.	The Dynamic Experiment Laboratory was not constructed, but weapons-related experiments were conducted: - None with actinides - Some with nonhazardous materials and high explosives - Some with high explosives, but none with depleted uranium. - No shock wave experiments.
	Provide support for static stockpile surveillance technology research and development.	Support was not provided for surveillance research and development.

CAPABILITY	SWEIS ROD[a]	1999 OPERATIONS
Accelerator Transmutation of Wastes (ATW)[c] (Continued)	Conduct lead target tests for two yrs at Area A beam stop.	No tests.
	Implement LIFT (Establish one-megawatt, then five-megawatt ATW target/blanket experiment areas) adjacent to Area A.	Neither the target/blanket experiment nor LIFT were constructed.
	Conduct five-megawatt experiments for 10 months/yr for four yrs using about three kg of actinides.	No experiments.
Subatomic Physics Research	Conduct 5 to 10 physics experiments/yr at Manuel Lujan Center, WNR facility, and LPSS.	UCN ran on 5 occasions in the Blue Room.
	Conduct proton radiography experiments, including contained experiments with high explosives.	Experiments involving contained high explosives were conducted on 10 days in 1999
Medical Isotope Production	Irradiate up to approximately 50 targets/yr for medical isotope production.	No production in 1999.
	Added production of exotic, neutron-rich, and neutron-deficient isotopes (requires modification of an existing target area).	No production in 1999.
High-Power Microwaves and Advanced Accelerators	Conduct research and development in these areas, including microwave chemistry research for industrial and environmental applications.	Research and development was conducted.

[a] Includes the completion of proton and neutron radiography facilities, the LEDA, the isotope production facility relocation, the Short-Pulsed Spallation Source enhancement, and the LPSS.
[b] Numbers of neutron experiments represent plausible levels of activity. Bounding conbditions for the consequences of operations are primarily determined by i) length and power of beam operation and ii) maintenance and construction activities.
[c] Formerly, Accelerator-Driven transmutation Technology. H(+) = proton (positively charged hydrogen ion), H(-) = negatively charged hydrogen ion

2.11.3 Operations Data for LANSCE

Since levels of operations were less than those projected by the ROD (LANSCE had a safety stand-down for part of the year), operations data were also less than projected. Radioactive air emissions are a key parameter since LANSCE emissions have historically accounted for more than 95% of the total LANL off-site dose. Emissions in 1999, however, totaled only 300 curies, about 15% of total LANL radioactive air emissions. The 1999 total was also significantly less than projections of the ROD (4185 curies). These small emissions can be attributed to non-use of the Area A beam stop.

Waste generation, NPDES discharge volumes, and utility consumption were also all below projected quantities. Table 2.11.3-1 provides details.

A new load frame will allow scientists to measure the effect of compressive or tensile stresses on the structure of materials. Tests of this sort on engineering components allow better predictions of failure modes and lifetimes during actual operation

Table 2.11.3-1. LANSCE/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Argon-41	Ci/yr	7.44E+1	1.4E+1
Bromine-76	Ci/yr	Not projected [a]	2.3E-4
Bromine-82	Ci/yr	Not projected [a]	6.3E-4
Carbon-10	Ci/yr	2.65E+0	4.2E-2
Carbon-11	Ci/yr	2.96E+3	2.8E2
Cobalt-60	Ci/yr	Not projected [a]	4.0E-6
Mercury-197	Ci/yr	Not projected [a]	1.6E-3
Nitrogen-13	Ci/yr	5.35E+2	1.6E+0
Nitrogen-16	Ci/yr	2.85E-2	1.50E-2
Oxygen-14	Ci/yr	6.61E+0	1.0E-1
Oxygen-15	Ci/yr	6.06E+2	1.9E+1
Tritium as Water	Ci/yr	Not projected [a]	2.3E+0
LEDA Projections (8-yr average):			
Oxygen-19	Ci/yr	2.16E-3	Not measured [b]
Sulfur-37	Ci/yr	1.81E-3	Not measured [b]
Chlorine-39	Ci/yr	4.70E-4	Not measured [b]
Chlorine-40	Ci/yr	2.19E-3	Not measured [b]
Krypton-83m	Ci/yr	2.21E-3	Not measured [b]
Others	Ci/yr	1.11E-3	Not measured [b]
NPDES Discharge: [c]			
Total Discharges	MGY	81.8	37.2
03A047	MGY	7.1	3.4
03A048	MGY	23.4	19.7
03A049	MGY	11.3	10.8
03A113	MGY	39.8	3.3
Wastes:			
Chemical	kg/yr	16,600	11,060
LLW	m^3/yr	1085 [d]	70
MLLW	m^3/yr	1	0.5
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	856	560 [e]

[a] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[b] Potential emissions from LEDA were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.
[c] Outfalls eliminated before 1999: 03A125 (TA-53), 03A145 (TA-53), and 03A146 (TA-53).
[d] LLW volumes include decommissioning and renovation of Experimental Area A (Building 53-03M).
[e] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.12 Health Research Laboratory (TA-43)

The HRL Key Facility includes the main HRL (Building 43-01) and 13 support buildings also located at TA-48. Research focuses on the study of intact cells, cellular components (RNA, DNA, and proteins), and cells and cellular systems (repair, growth, and response to stressors). There are several Low Hazard nonnuclear buildings within this Key Facility, but no Moderate Hazard nonnuclear facilities and no nuclear facilities.

2.12.1 Construction and Modifications at HRL

In calendar year 1999, HRL eliminated the entire animal colony. Outfall 03A040 was eliminated from the NPDES permit on January 11, 1999. The discharge from this outfall was redirected to the Los Alamos County sewage treatment plant in Bayo Canyon in 1998.

Research activities involving radioactive material were moved into the space previously occupied by the animal colony. The volume of radioactive work at HRL has significantly diminished from previous years. This is attributed to technological advances and new methods, such as the use of laser-based instrumentation and chemiluminescense, which do not require the use of radioactive materials. For instance, DNA sequencing predominantly uses laser analysis of fluorescent dyes hooked onto DNA bases instead of radioactive techniques.

Currently, HRL has Biosafety Level 1 and Level 2 work, which will include in the next one to two years limited work with potentially infectious microbes and low-toxicity biotoxins. These activities are regulated by the Centers for Disease Control, LANL's Institutional Biosafety Committee, and the Biosafety Officer.

2.12.2 Operations at HRL

The SWEIS identified eight capabilities for the HRL Key Facility. In 1998, neurobiology research was moved to another facility (the Physics Building at TA-03). In 1999, as part of the establishment of the Bioscience Division, three of the capabilities were renamed, two were combined at a higher level, and one was further defined into two operations as shown below:

- Genomic Studies was renamed Genomics
- Environmental Effects was renamed Environmental Biology
- Structural Cell Biology was renamed Structural Biology
- Cell Biology and DNA Damage and Repair were combined to form Molecular Cell Biology
- Cytometry was further defined as operations in Measurement Science and operations in Diagnostics and Medical Applications

The Bioscience Division developed three other operations in 1999 (Biologically Inspired Materials and Chemistry, Computational Biology, and Molecular Synthesis). These activities were just started and will be covered in the 2000 Yearbook. Since the development of information for the SWEIS, Bioscience Division has grown beyond its single facility, HRL. Therefore, the 2000 Yearbook will handle Bioscience Division similar to other Key Facilities where its various parts are in multiple buildings or TAs.

Table 2.12.2-1 compares 1999 operations to those predicted by the ROD. The table includes the number of FTEs per capability to measure activity levels to the ROD. These FTEs are not measured the same as the index shown in Table 2.12.3-1 and these numbers cannot be directly compared. Three of the existing capabilities currently have activity levels greater than those projected by the ROD, and the other four are conducted at levels equal to or lower than those projected by the ROD.

Table 2.12.2-1. Health Research Laboratory (TA-43)/Comparison of Operations

CAPABILITIES	SWEIS ROD	1999 OPERATIONS
Genomic Studies – Renamed Genomics in 1999	Conduct research utilizing molecular and biochemical techniques to analyze the genes of animals, particularly humans. Develop strategies at current levels to analyze the nucleotide sequence of individual genes, especially those associated with genetic disorders, and to map genes and/or genetic diseases to locations on individual chromosomes. Part of this work is to map each nucleotide, in sequence, of each in all 46 chromosomes. (50 FTEs) [a]	In 1999, 61 FTEs were associated with Genomics. This exceeds the SWEIS ROD of 50 FTEs and is an increase of 56% over 1995 levels.

CAPABILITIES	SWEIS ROD	1999 OPERATIONS
Cell Biology and DNA Damage and Repair – Combined into Molecular Cell Biology in 1999	Conduct research at current levels utilizing whole cells and cellular systems, both in-vivo and in-vitro, to investigate the effects of natural and catastrophic cellular events like response to aging, harmful chemical and physical agents, and cancer. (35 FTEs) Conduct research using isolated cells to investigate DNA repair mechanisms. (35 FTEs)	In 1999, 30 FTEs were associated with Molecular Cell Biology. This is less than half of the 70 FTEs projected in the ROD. In 1995, a total of 50 FTEs were associated with Cell Biology and DNA Damage and Repair.
Cytometry	Conduct research utilizing laser imaging systems to analyze the structures and functions of subcellular systems. (40 FTEs)	In 1999, 25 FTEs were associated with Measurement Science and Diagnostics a specialized application of cytometry, microscopy, spectroscopy, and other techniques for molecular detection and diagnosis. In 1999, 10 FTEs were associated with Medical Applications utilizing laser based molecular analysis techniques to develop tools for clinical diagnosis of disease. The 35 total FTEs in Cytometry is below the 40 FTEs projected in the ROD.
Environmental Effects – Renamed Environmental Biology in 1999.	Research identifies specific changes that occur in DNA and proteins in certain microorganisms after events in the environment. (25 FTEs)	In 1999, 25 FTEs were associated with Environmental Biology. This equals the SWEIS ROD and is an increase of 25% over 1995 levels.
Structural Cell Biology – Renamed Structural Biology in 1999.	Conduct research utilizing chemical and crystallographic techniques to isolate and characterize the properties and three-dimensional shapes of DNA and protein molecules. (15 FTEs)	In 1999, there were 60 FTEs associated with this capability. This exceeds the SWEIS ROD of 15 FTEs and is an increase of 500% over 1995 levels.
Neurobiology	Conduct research using magnetic fields produced in active areas of the brain to map human brain locations associated with certain sensory and cognitive functions. Instrumentation in sensitive magnetic detection devices. (9 FTEs)	Not applicable. Relocated to another LANL facility in 1998 (the Physics Building in TA-03).
In-Vivo Monitoring	Perform 3000 whole-body scans per year as a service to the LANL personnel monitoring program, which supports operations with radioactive materials conducted elsewhere at LANL. (5 FTEs)	Conducted 1250 whole-body scans and 1733 other counts (detector studies, quality assurance measurements, etc.). In 1999, there were 3 FTEs associated with this capability.

[a] FTEs: full-time-equivalent scientists, researchers, and other staff supporting a particular research capability.

2.12.3 Operations Data for HRL

Research levels have remained relatively constant from 1998 to 1999. However, the research focus is changing as seen by the changes in capabilities and also the advances in technology.

Table 2.12.3-1 presents the operations data as measured by radioactive air emissions, NPDES discharges, generated waste volumes, and number of workers. The generation of most waste (chemical, biological, and MLLW) has decreased from historical levels and was smaller than projections.

Table 2.12.3-1. Health Research Laboratory (TA-43)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions	Ci/yr	Not estimated	Not measured [a]
NPDES Discharge: [b]			
03A040	MGY	2.5 [c]	Eliminated [d]
Wastes:			
Chemical	kg/yr	13,000	1691
Biomedical Waste	kg/yr	280 [e]	0
LLW	m^3/yr	34	14
MLLW	m^3/yr	3.4	0.01
TRU/Mixed TRU	m^3/yr	0	0
Number of Workers	FTEs	250	98 [f]

[a] Potential emissions during the period were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.
[b] Outfall 03A040 consisted of one process outfall and nine storm drains.
[c] Storm water only.
[d] Outfall was eliminated 1/11/99.
[e] Animal colony and the associated waste. The animal colony was eliminated in 1999.
[f] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD or FTE numbers by capability (see Section 3.6, Socioeconomic) is not appropriate.

HRL (lower left) adjacent to the Los Alamos Medical Center

3-D Multicellular Spheroid Model, mimics the microenvironment surrounding cells in a solid tumor. Shown here is a technician replenishing the culture medium for the spheroid cells.

2.13 Radiochemistry Facility (TA-48)

The Radiochemistry Key Facility includes all of TA-48 (116 acres). This facility fills three roles—research, production of medical radioisotopes, and support services to other LANL organizations, primarily through radiological and chemical analysis of samples. TA-48 contains five major research buildings: the Radiochemistry Laboratory (Building 48-01), the Isotope Separator Facility (48-08), the Diagnostic Instrumentation and Development Building (48-28), the Advanced Radiochemical Diagnostics Building (48-45), and the Analytical Facility (48-107). The Radiochemistry Laboratory (Building 48-01) is a candidate Category 3 nuclear facility.

2.13.1 Construction and Modifications at the Radiochemistry Facility

The ROD projected no facility changes through 2005. Consistent with this projection, only minor maintenance activities occurred during 1999. For example, there were some office modifications, a chiller was replaced, and some basement ventilation was removed.

In addition, the only remaining NPDES outfall, 03A045, was eliminated from the Laboratory's NPDES permit on December 6, 1999. Industrial sources that had previously discharged to this outfall (a cooling tower and basement floor drains) have been eliminated or redirected. The cooling tower was removed from service in 1996 and the floor drains were either plugged or piped to the Laboratory's sanitary wastewater system (SWS). The elimination of outfalls was evaluated through an environmental assessment (DOE 1996a) and subsequent Finding of No Significant Impact.

2.13.2 Operations at the Radiochemistry Facility

The SWEIS identified ten capabilities for the Radiochemistry Key Facility. No new capabilities have been added, and none have been deleted. The primary measure of activity for this Key Facility is the number of personnel conducting research. In 1999, approximately 170 chemists and scientists were employed, far below the 250 projected by the ROD. As seen in Table 2.13.2-1, only thee of the ten capabilities were active at levels projected by the ROD: radionuclide transport studies, actinide and TRU chemistry, and sample counting. The number of FTEs shown by capability is not calculated the same as the index shown in Table 2.13.3-1, and these numbers cannot be directly compared.

Table 2.13.2-1. Radiochemistry Facility (TA-48)/Comparison of Operations

CAPABILITY	SWEIS ROD [a]	1999 OPERATIONS [a]
Radionuclide Transport Studies	Actinide transport, sorption, and bacterial interaction studies. Development of models for evolution of groundwater. Assessment of performance or risk of release for radionuclide sources at proposed waste disposal sites. Increased level of operations, approximately twice the current (1995) levels. (28 to 34 FTEs)[b]	Increased level of operations, approximately twice 1995 levels. (35 FTEs)
Environmental Remediation Support	Background contamination characterization pilot studies. Performance assessments, soil remediation research and development, and field support. Increased level of operations, approximately twice the current (1995) levels. (34 FTEs)	Decreased level of operations, approximately half 1995 levels. (10 FTEs)
Ultra-Low-Level Measurements	Isotope separation and mass spectrometry. Increased level of operations, approximately twice the current (1995) levels. (30 FTEs)	Level of operations was approximately the same as in 1995. (14 FTEs)

CAPABILITY	SWEIS ROD [a]	1999 OPERATIONS [a]
Nuclear/Radiochemistry	Radiochemical operations involving quantities of alpha-, beta-, and gamma-emitting radionuclides for non-weapons and weapons work. Slight increase over current (1995) levels of operation. (44 FTEs)	Slightly decreased level of operations, but approximately the same as 1995 levels. (35 FTEs)
Isotope Production	Target preparation. High-level beta/gamma chemistry and target processing to recover isotopes for medical and industrial application. Increased level of operations, approximately twice the current (1995) levels. (15 FTEs)	Slightly increased level of operations, approximately the same as in 1995. (11 FTEs)
Actinide/TRU Chemistry	Radiochemical operations involving significant quantities of alpha-emitting radionuclides. Increased level of operations, approximately twice the current (1995) levels. (12 FTEs)	Increased operations, approximately twice 1995 levels. (13 FTEs)
Data Analysis	Re-examination of archive data and measurement of nuclear process parameters of interest to weapons radiochemists. Increased level of operations, approximately twice the current (1995) levels. (10 FTEs)	Slight increase from 1995 to six FTEs, but less than projected by the SWEIS ROD.
Inorganic Chemistry	Synthesis, catalysis, actinide chemistry: - Chemical synthesis of new organo-metallic complexes - Structural and reactivity analysis, organic product analysis, and reactivity and mechanistic studies - Synthesis of new ligands for radiopharmaceuticals Environmental technology development: - Ligand design and synthesis for selective extraction of metals - Soil washing - Membrane separator development - Ultrafiltration Increased level of operations, approximately 50% more than the current (1995) levels. (49 FTEs—total for both activities)	Same level of activity as in 1995 (35 FTEs), but below projections of the SWEIS ROD.
Structural Analysis	Synthesis and structural analysis of actinide complexes at current levels. X-ray diffraction analysis of powders and single crystals at current levels. Increased level of operations, approximately twice the current (1995) levels. (22 FTEs)	Decreased level of operations from 1995, and about 1/3 of those projected by the SWEIS ROD. (8 FTEs)
Sample Counting	Measurement of the quantity of radioactivity in samples using alpha-, beta-, and gamma-ray counting systems. Level of operations, similar to the current (1995) levels. (5 FTEs)	Approximately the same as SWEIS ROD. (6 FTEs)

[a] Projections in the ROD were made as increments to the current level of operations as expressed by the "No Action" alternative for the current (1995) year. Thus, 1999 operations must use increments from 1995 operational levels for comparison purposes.
[b] FTEs: full-time-equivalent scientists, researchers, and other staff supporting a particular research capability.

2.13.3 Operations Data for the Radiochemistry Facility

The overall level of activity at the Radiochemistry Facility was below that projected by the ROD. Three of the ten capabilities at this Key Facility were conducted at levels projected by the ROD; the others were at or below activity levels of 1995. As a result, operations data were also below those projected by the ROD, as shown in Table 2.13.3-1.

Table 2.13.3-1. Radiochemistry Facility (TA-48)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Mixed Fission Products	Ci/yr	1.4E-4	Not reported [a]
Plutonium-239	Ci/yr	1.1E-5	None detected [b]
Uranium-235	Ci/yr	4.4E-7	None detected [b]
Mixed Activation Products	Ci/yr	3.1E-6	Not reported [a]
Uranium-238	Ci/yr	Not projected [c]	6.0E-10
Arsenic-72	Ci/yr	1.1E-4	None detected [b]
Arsenic-73	Ci/yr	1.9E-4	1.8E-5
Arsenic-74	Ci/yr	4.0E-5	4.5E-5
Beryllium-7	Ci/yr	1.5E-5	None detected [b]
Bromine-77	Ci/yr	8.5E-4	1.2E-5
Germanium-68	Ci/yr	1.7E-5	1.7E-3
Gallium-68	Ci/yr	1.7E-5	1.7E-3
Rubidium-86	Ci/yr	2.8E-7	None detected [b]
Selenium-75	Ci/yr	3.4E-4	3.5E-4
Silicon-32	Ci/yr	Not projected [d]	5.1E-6
NPDES Discharge:[e]			
Total Discharges	MGY	4.1	No discharge
03A-045	MGY	0.87	Eliminated [f]
Wastes:			
Chemical	kg/yr	3300	1513
LLW	m^3/yr	270	40
MLLW	m^3/yr	3.8	0.6
TRI/Mixed TRU [g]	m^3/yr	0	0
Number of Workers	FTEs	248	128 [h]

[a] Emission categories of 'mixed fission products' and 'mixed activation products' are no longer used. Instead, where fission or activation products are measured, they are reported as specific radionuclides, e.g., Cs-137 or Co-60.
[b] Although stack sampling systems were in place to measure these emissions, any emissions were sufficiently small to be below the detection capabilities of the sampling systems.
[c] The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.
[d] The Si-32 emissions were not expected. There was a slight process problem that resulted in these emissions. The dose from these emissions was not significant.
[e] Outfalls eliminated before 1999: 04A016 (TA-48), 04A131 (TA-48), 04A152 (TA-48), and 04A153 (TA-48).
[f] This outfall was eliminated from the NPDES permit on 12/6/99.
[g] TRU waste was projected to be returned to the generating facility.
[h] The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.